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AUTOMOTIVE INDUSTRIES

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Structural Steels for Cars, Trucks and Farm Equipment

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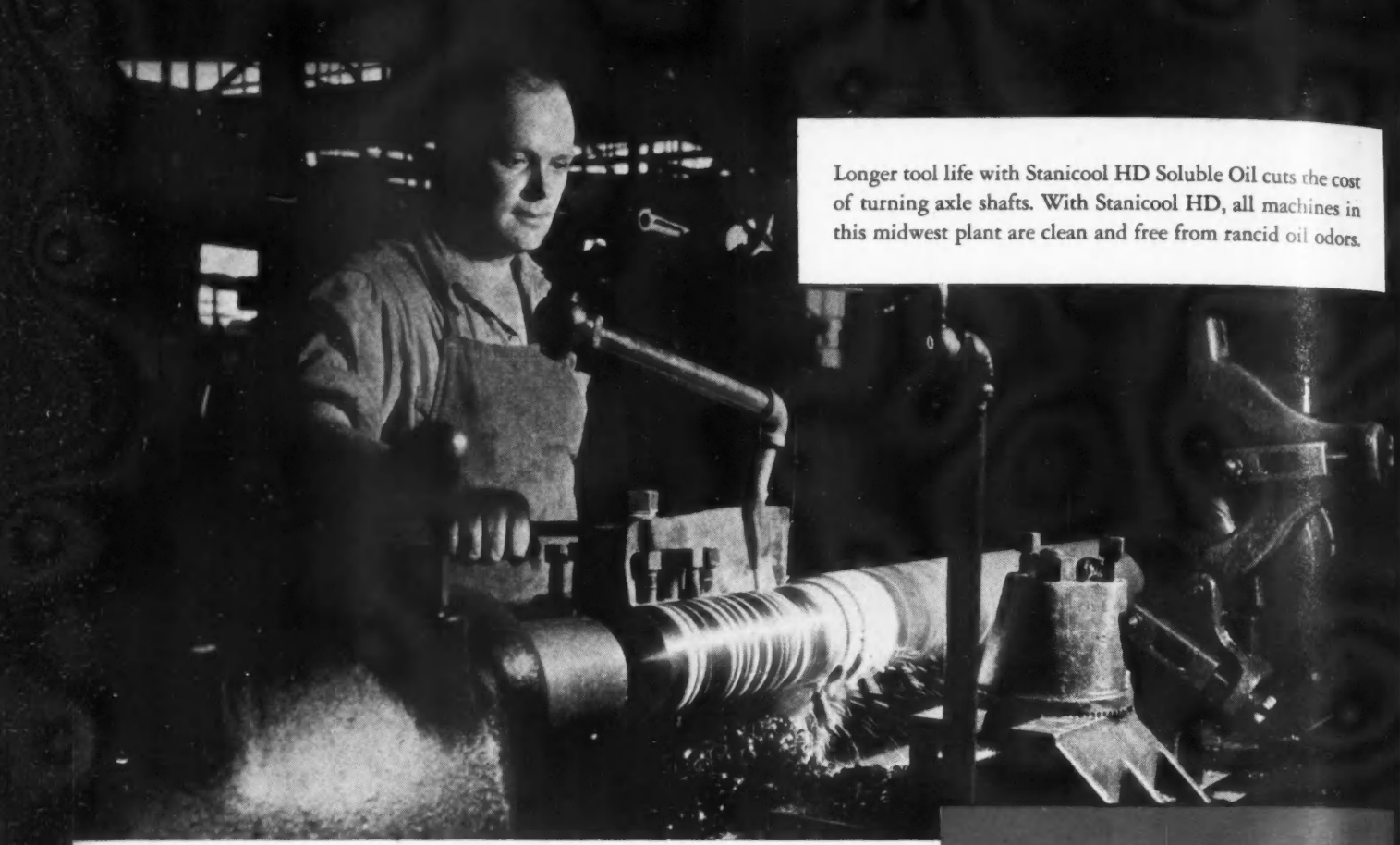

Longer tool life with Stanicool HD Soluble Oil cuts the cost of turning axle shafts. With Stanicool HD, all machines in this midwest plant are clean and free from rancid oil odors.

How one cutting fluid replaced two ...solved knotty problem...

Stanicool HD Soluble Oil

• A troublesome cutting oil problem bothered a midwest metalworking plant. Soluble oil was supplied from a central tank to machines doing a wide variety of turning and boring jobs. However, a few operations, such as tapping and reaming, performed on these machines required a black cutting oil which was swabbed on the tool. When the black oil became mixed with the soluble oil it dirtied the machines. It also was carried to the central tank, where it covered the surface of the coolant and caused rancidity.

On a Standard Oil Engineer's recommendation, both oils were replaced with Stanicool HD Soluble Oil. The central tank was filled with Stanicool HD, and a concentrated mixture of four parts Stanicool HD to one part water was used on taps and reamers in place of the black cutting oil.

Stanicool HD proved superior both as a coolant and as a cutting oil. It gave clean operation, eliminated oil rancidity and odor, and reduced by 50% the time and cost of cleaning the central tank. It increased tool life on all machining operations and saved stocking a special cutting oil for taps and reamers.

Ask a Standard Cutting Oil Specialist to show you how this dual-purpose coolant can improve tool life, increase production, and reduce the number of cutting oils in your plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

Stanicool HD eliminated the additional use of a black cutting oil on this boring machine. Life of taps and reamers was markedly increased.

STANDARD OIL COMPANY (INDIANA)

STANDARD

AUTOMOTIVE INDUSTRIES

Published Semi-Monthly

April 1, 1948 Vol. 98, No. 6

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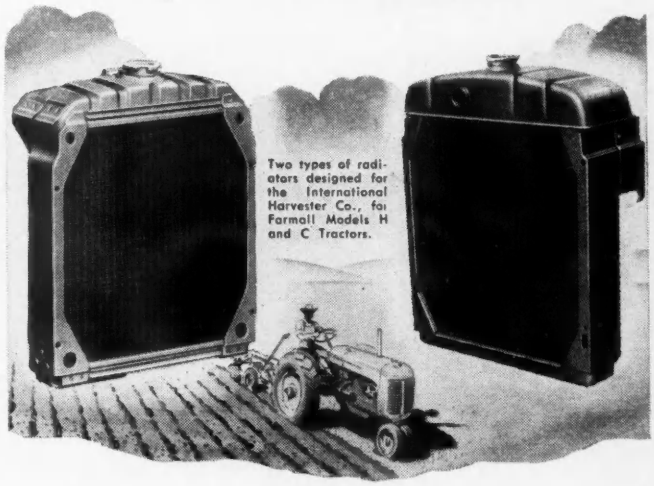
Radiators

FOR THE TRACTOR INDUSTRY

by **YOUNG**



Two types of radiators designed for the International Harvester Co., for Farmall Models H and C Tractors.

● Equipped with the most modern machines and using the most advanced production techniques, Young offers tractor manufacturers the high-production facilities that assure the most value per dollar expended. To this manufacturing ability is added engineering experience. Young Heat Transfer Specialists develop the radiator for the particular job, assuring the trouble-free performance and adequate cooling that pay off in customer satisfaction for manufacturer and dealer alike.

YOUNG

HEAT TRANSFER PRODUCTS

Young Quality

YOUNG RADIATOR CO.

Dept. 218-D, Racine, Wis., U.S.A.

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Gas, gasoline, Diesel engine cooling, radiators • Jacket water coolers • Heat exchangers • Intercoolers • Condensers • Evaporating coolers • Oil coolers • Gas coolers • Atmospheric cooling and condensing units • Supercharger intercoolers • Aircraft heat transfer equipment

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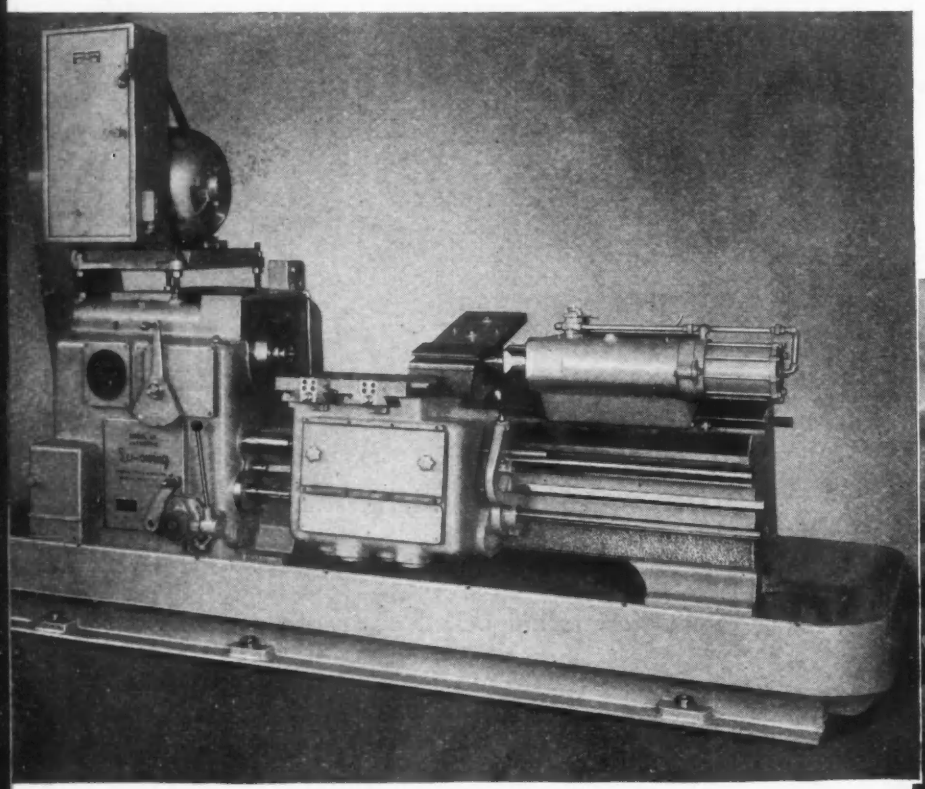
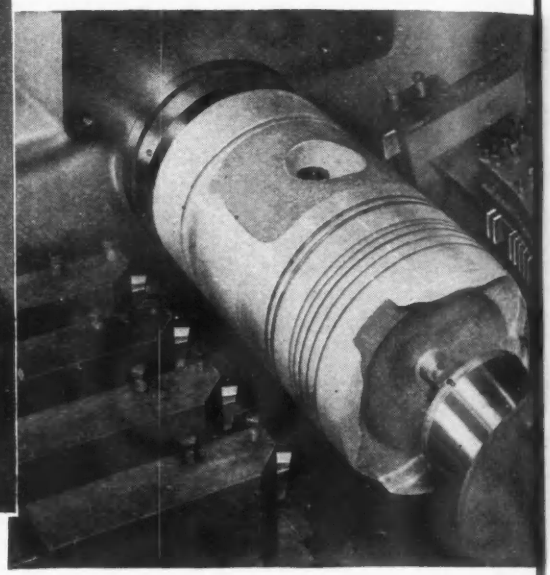
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Front view of machine without tooling.

Close-up view showing tooling.



Lo-swing MODEL AR LATHE EQUIPPED FOR TURNING DIESEL MOTOR PISTONS

Problem: **To automatically turn, groove and face special alloy pistons having a maximum diameter of 8".**

Solution: **The Model AR Lo-swing was selected for this job due to its rigidity and "Simplified Change-over Mechanism" which permits changing over from one size piston to another in a few minutes by simply making a few adjustments in gear segments and cam which controls cross slide and rapid traverse movements.**

The work is centered on the driven end with an adapter plate machined to fit the bore of the open end of the piston which has been previously machined. This adapter is fitted with a hardened steel driving plate which contacts a lug cast on the inside piston wall, assuring a positive drive. The piston is supported on the tailstock end with a standard 60° revolving type center.

The turning operation consists of machining the outside diameters with four tools mounted on a single cross slide. The grooving and facing tools are clamped on two independently operated Back Squaring Attachments, the movements of which are synchronized with the front slide.

The end facing tool is mounted in a special relieving type tool block (see close-up view) which automatically relieves the tool on the return stroke, preventing any scoring or marking of the finished face.

Sintered carbide tools are used on this job and a high grade finish is obtained on the ring grooves.

Seneca Falls Engineers are always at your disposal to help find cost cutting solutions for your turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

AUTOMOTIVE INDUSTRIES

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AUTOMOTIVE INDUSTRIES
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High Spots of This Issue

Canada's Quota System for American Cars

New Government regulations announced by Canada for 1948 will cut imports of U. S. new passenger cars and trucks to 16 per cent of the previous annual dollar volume. In this way, Canadian officials have opened way for $7½ million worth of new British cars during 1948, as compared to $2 million for 1947. Complete information on the new quota system is given on page 25.

Alloy Steels in Motor Vehicles

Principal applications of constructional alloys steels in passenger cars, trucks and farm equipment are discussed in a comprehensive article on page 26. It was prepared exclusively for AUTOMOTIVE INDUSTRIES by M. J. Day, metallurgical engineer for the Carnegie-Illinois Steel Corp.

Hudson's Final Assembly Layout

Hudson's techniques for final assembly of the new Monobilt body is the subject of this production article by Detroit Editor Joseph Geschelin, beginning on pages 28 and 29.

Developments in Engine Cooling

Latest types of thermostatically controlled engine fans, and a wax-filled thermostat for air-cooled oil coolers are among the developments discussed by Fred M. Young on pages 38 and 39.

Induction System for Boeing B-50

Besides supplying the engines with combustion air, the B-50 induction system furnishes cooling and ventilating air to various accessories, and provides pressurized air for the cabin. Complete description of the system is given on pages 44 and 45.

23 New Product Items And Other High Spots Such As:

Research and development of Russian motor vehicles; huge machinery for manufacturing weather; first transfer machine for drilling crankshaft oil holes; an engineering omission that cost $16,000,000 and 52 lives; the increasing demand for petroleum products; Ford's new extrusion method of forging front spindles; and several new European engine designs.

News of the Automotive Industries, Page 17

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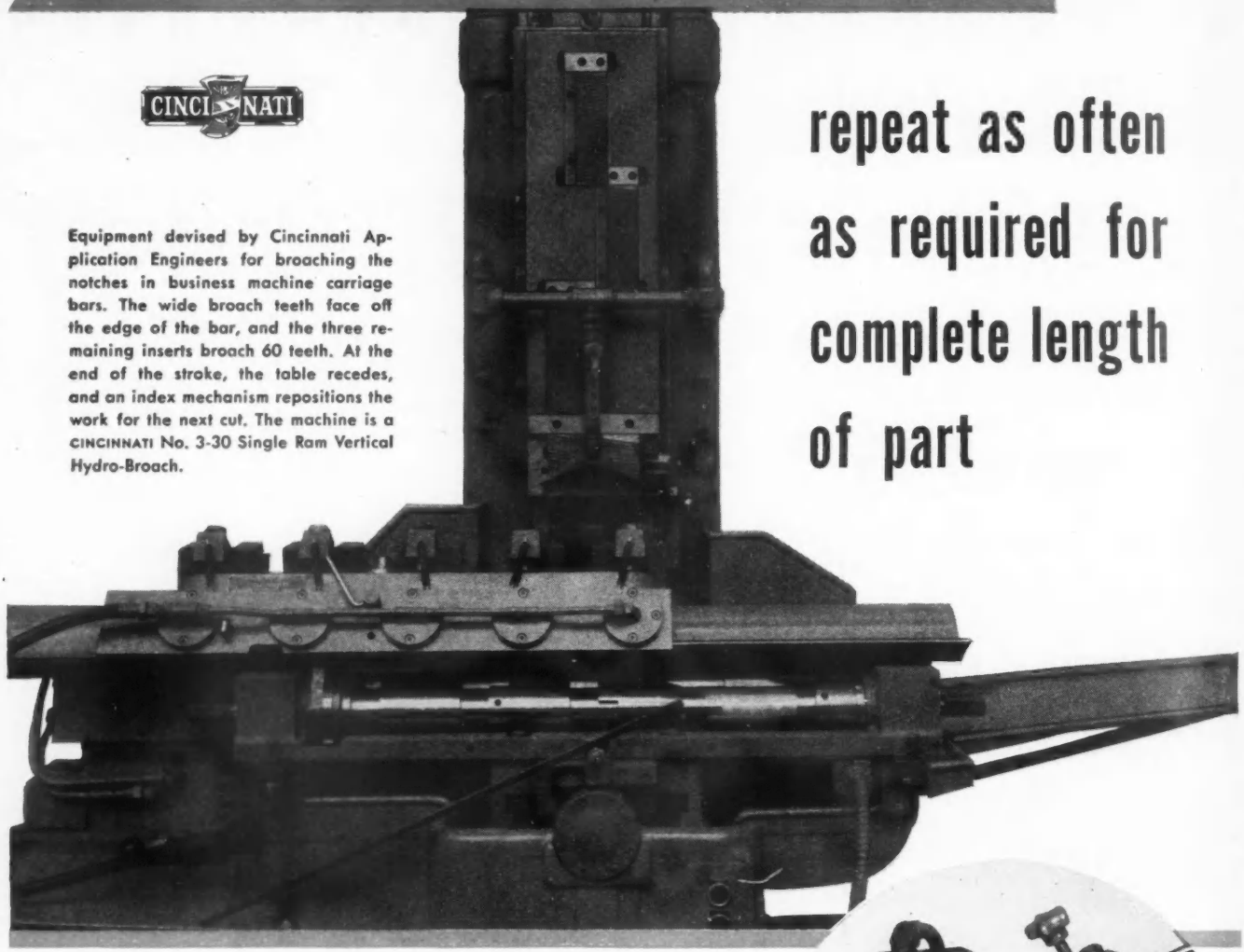
BROACH, INDEX LATERALLY, BROACH...

CINCINNATI

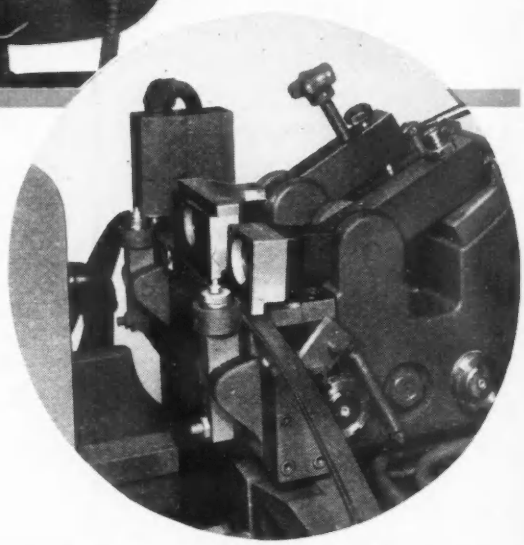
repeat as often as required for complete length of part



Equipment devised by Cincinnati Application Engineers for broaching the notches in business machine carriage bars. The wide broach teeth face off the edge of the bar, and the three remaining inserts broach 60 teeth. At the end of the stroke, the table recedes, and an index mechanism repositions the work for the next cut. The machine is a CINCINNATI No. 3-30 Single Ram Vertical Hydro-Broach.

How long can a broached surface be? On flexible parts, like band saw blades, it can be up to 700 feet long! Rigid parts, like carriage stop bars, have been up to 30 in. long! These long parts are today being broached on CINCINNATI Hydro-Broach Machines, at production rates never before approached. Examples are shown here. The operating cycle is automatic and follows a basic pattern . . . broach, index laterally, broach, and repeat for complete length of part. It offers a new and extremely low cost method of machining notches, teeth or similar contours, evenly or irregularly spaced, in long parts. And the method can be extended still further . . . broaching and cutting off short pieces made from bar stock. Our Application Engineers will help you explore the possibilities. As a starter, send blueprint of part with complete details.

CINCINNATI No. 3-48 Single Ram Vertical Hydro-Broach. Specifications may be obtained by writing for catalog M-1389-2.



Close-up of fixture for broaching the teeth in band saw blades, on a CINCINNATI No. 3-30 Single Ram Vertical. The cycle is automatic, and incorporates a shuttling fixture which repositions the work for each downward stroke of the ram. Taking a cut 6 in. wide, 2500 feet of saw teeth are broached per hour.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES

NEWS of the AUTOMOTIVE INDUSTRIES

Vol. 98, No. 6 April 1, 1948

March Car Output Steady

Automobile production in March continued at a steady pace of between 110,000 and 115,000 cars and trucks a week, but a combination of factors appeared to prevent the industry from getting in a concerted push to much more than that. After Chrysler and Packard recovered from the setback occasioned by the natural gas shortage which kept them idle for two weeks in February, Kaiser-Frazer cut back production schedules from around 1000 cars a day to between 700 and 750. As other companies improved their production a bit to take up that slack, Ford started to cut back schedules for model changeover which further reduced total production. Although Lincoln and Mercury lines started on 1949 models during the month, delays incident to new model production delayed progress considerably, so that combined Ford production for March was off importantly.

Another complication that did not immediately affect automobile production, but that posed a serious potential effect, was the walkout of coal miners in mid-March. Consensus in the industry is that if the stoppage continued for three weeks to a month, steel production would be so curtailed that automobile production would have to be cut back, and if it continued longer than that, output would have to be reduced drastically or stopped altogether. Up to the end of March, the industry as a whole was about 10 per cent ahead of 1947 production, with the millionth vehicle completed before the middle of the month.

Engine Changes Featured in '48 Kaisers & Frazers

In addition to the raised compression ratio of 7.3 to 1 other engine changes in the newly introduced '48 Kaisers and Frazers include stiffening of the crankcase and block by increasing wall thickness and adding reinforcing ribs on the manifold side; adoption of copper-lead bearing in place of babbitt-type formerly used; use of oilless bearing material for the pilot bushing at the rear end of the crankshaft to provide permanent lubrication of the clutch shaft; adoption of self-locking tappets instead of lock nuts to improve ease of adjustment; relocation of the timing pointer from the flywheel to front of the engine for more accessibility; a new triple-tooth roller gear in the steering mechanism; adoption of an aluminum master brake cylinder to replace the cast iron unit; and relocation of the fuel pump and exhaust outlet to eliminate vapor lock. Prices of the new models remain unchanged.

Hudson Output Goal Is 1000 Cars a Day

Hudson Motor Car Co. reports that production is increasing rapidly on its newly styled models which were introduced last October. Current production exceeds 600 cars a day, and the company is aiming at a goal of 1000 daily, and a total volume this year 40 per cent higher than in 1947. Hudson recently acquired sheet metal capacity at New Castle, Pa. which is expected to furnish about 5000 tons of steel monthly.

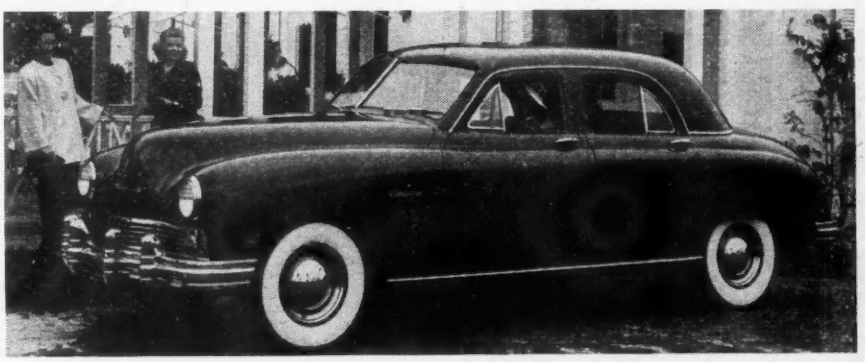
Complete First Tucker on New Pilot Line

Tucker Corp. completed the first car on its new assembly line recently, just a few minutes before the first stockholders meeting opened. To refute reports that the car did not have a reverse gear, as reported at the time of the showing of the first hand-built model, Preston T. Tucker, president, backed the car several times. He told stockholders that the company has enough steel under commitment to produce between 160 and 240 cars a day exclusive of any it will get if it is able to lease the WAA blast furnace plant at Cleveland now operated by Republic Steel Corp. He said the plant would be used to provide pig iron which could be traded for sheet steel.

The Tucker plant is currently being prepared for production and schedules call for 125 cars to be completed by June. Plans call for eventual production of 120 cars an hour. Tucker said that the biggest problem facing the company has been the procurement of body dies, and that only a small part of those required have been delivered. He estimated that the price of the car, although not definitely set, will be between $1800 and $1900, and that the company should begin to make money when production reaches 157 units a day.

Tire Makers Adjust Output To Fit Demand

The recent cutback in tire production does not necessarily reflect a sharp break in the market, according to tire manufacturers. They say that they are merely adjusting schedules to meet current demands following the filling of backlog orders. Since the end of the war, tire production has been phenomenal in order to meet pent-up demand, and has now leveled off at a level much higher than prevailed in 1941. The industry currently has capacity about 40 per cent greater than prewar. Another indication that tires are back in a buyers' market is the report that one of the larger companies is planning to bring out a second line tire. Several smaller companies have offered second line units for several months now.



'48 FRAZER MANHATTAN

Now in full production at Willow Run, Kaiser-Frazer's four new 1948 models are powered by a six-cyl engine with a compression ratio of 7.3 to 1. New low-pressure super-cushion tires are standard equipment on all models.

NEWS *of the* AUTOMOTIVE INDUSTRIES

Big Order Backlog For Ford Heavy Trucks

Ford Motor Co. reports that it has on hand enough orders for its new 2½ and three ton extra heavy duty trucks to absorb almost the entire 1948 production. Orders have been coming in rapidly, despite the acknowledged sag in the heavy duty truck market. It is generally conceded by truck sales managers that practically all model trucks, except panels and light deliveries, will be on a vigorous competitive selling basis by the end of 1948. Dealer inventories of heavy trucks are already sizable, and the used truck market in heavy categories is extremely slow.

Davis Ready to Produce 3-Wheeled Car

Davis Motor Car Co. of Los Angeles, Calif., was scheduled to start production of its three-wheeled light automobile late in March. In the beginning output was expected to be in the neighborhood of 50 cars a day. The company also plans to establish plants in various parts of the country for an eventual daily production of 1500 to 2000 units. During the early stages the dealer organization will be confined to the West Coast area. A company official stated that manufacture of the car will be entirely on a subcontracting basis.

Sheet Steel Holds Back Nash West Coast Assembly

Although Nash Motors has named Howard G. Coats factory superintendent of its new assembly plant at El Segundo, Calif., operations are not expected to begin there for a while. The plant is currently being equipped, but will not be used for car assembly until the sheet steel supply improves, probably late next fall.

Natural Rubber May Replace Butyl in Car Tires

As a result of experience with butyl rubber inner tubes under the extremely cold weather of the past winter, tire manufacturers are faced with a decision as to whether or not to continue using butyl tubes in passenger car tires. There have been many cases in extremely cold areas in which the butyl tubes stiffened at low temperature causing chafing within the tire and ultimate leaks. Tire engineers explain that the stiffened tube does not warm up as rapidly as the tire, and consequently has a tendency to fold, causing chafing and leakage. There is some belief that natural rubber tubes may be used in passenger cars and butyl tubes in truck tires since the higher pressure carried in truck casings appears to prevent damage.

Used Car Dealers Hit By Market Slump

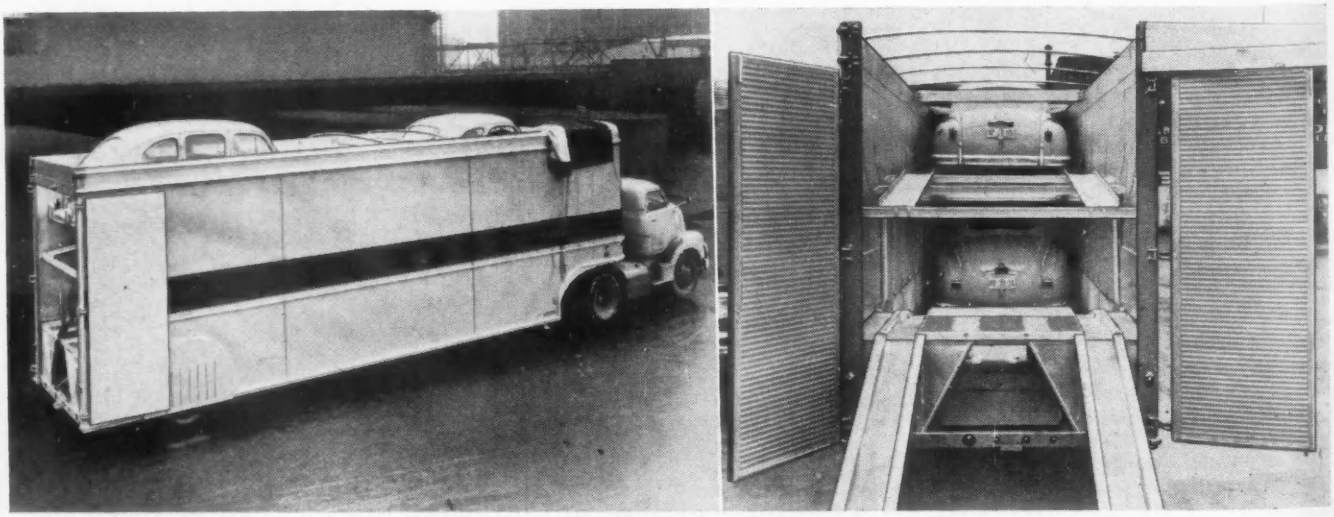
With the continuing sag in the used car market, many Detroit used car operators are reported to be in financial difficulty. Finance companies are said to be tightening credit extension and are cutting down the percentage of cars they will finance and in some cases are refusing to take on new clients. Repossessions are said to be climbing rapidly with the repossession loss per vehicle averaging 50 to 100 per cent higher than a few months ago. The market is expected to improve with warm weather.

Dim Output Prospect For High Octane Fuel

Robert E. Wilson, chairman of the board of the Standard Oil Co., is not optimistic about quantity production of high octane gasoline for high compression automobile engines in appreciable quantities during the next two or three years. At a press conference in Detroit he pointed out that the demand for petroleum products is so great that all efforts will be in the direction of volume until the pressure is relieved.

Change Ignition Systems to Cut Radio Interference

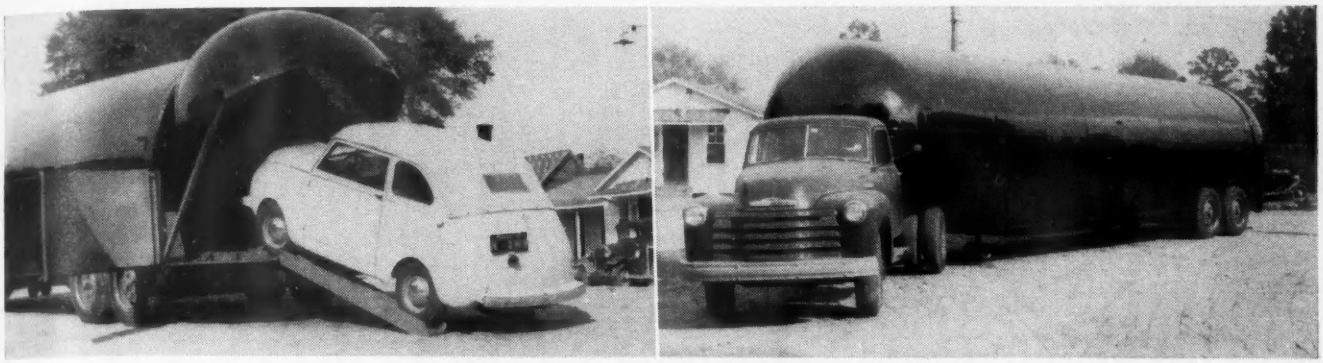
All car, truck, and bus manufacturers now have complied with recommendations made by AMA in rearranging electrical systems so that interference with television broadcasts is cut to a minimum. The recommendations were submitted by the SAE sub-committee on radio interference after consultation with the Radio Manufacturers Association. Alterations consist principally in shortening high tension leads to no longer than eight inches, or by shielding those longer than that. Leads have been shortened in most cases by moving coil closer the distributor.



CONVERTIBLE FOR COMBINATION

This new drop-frame assembly semi-trailer, designed by W. O. Bridge, member of the board of Bridgeways, Inc., Detroit, can be converted from a general freight carrier to a haulaway capable of transporting four passenger cars. In varying combinations, this vehicle can also carry cars and general freight simultaneously. It measures 35 ft in length, eight ft in width, and 12.5 ft in height when loaded. Cars are carried on the primary level and on the top level. Inasmuch as all movable parts for structural alterations are of aluminum, one man can perform the necessary changes.

NEWS *of the* AUTOMOTIVE INDUSTRIES



COMBINATION FOR TRANSPORTATION

Designed and built by Dorsey Trailers, Inc., Elba, Ala., for the Empire Neon Sign Co., Savannah, Ga., this combination transport and display van can carry three small Crosley-type passenger cars as well as products to be displayed or sold. Representatives ride in the cab of the tractor, park the van upon reaching town, and then run out the three cars for canvassing, delivery or installation.

Sharp Decline in Demand for Heavy Trucks

There is no longer any doubt that in general the overall market for heavy duty trucks has slipped badly. One manufacturer of large heavy duty units says that they have had more than 100 cancellations, and have had considerable difficulty in selling the trucks elsewhere. Practically all large truck dealers have sizable inventories in stock. In the medium and lighter classifications, the market has not sagged noticeably, but it shows soft spots in scattered locations principally in larger cities. Used truck business is off badly in most places with the only activity in light panel and pickup jobs. An exception to the rule in the heavy class appears to be the new Ford line which the company claims has been sold out for the rest of this year. Ford has started a second shift on the truck assembly line to raise production to more than 300 units a day.

Labor

Wage Talks Underway At GM and Chrysler

Although GM and Chrysler are already engaged in wage talks with the UAW-CIO, the general consensus is that no major settlement will be forthcoming for several weeks. Chrysler negotiations have already been recessed for lengthy periods from time to time, and GM negotiations are still in the early stages. The entire GM contract is up for consideration this year, and in view of the many fringe demands of the union, it is obvious that many long hours of discussion will be necessary to arrive at a settlement. The union has filed a strike notice against Chrysler Corp., and one will soon be forthcoming in the case of GM. These are considered merely to be precautionary measures by the union, and not likely to be put into effect. The union has also served demands on Briggs Mfg. Co., supplier of bodies to Chrysler and Packard, approximating the demands made on GM, and totaling about 30 cents an hour.

Fringe Payments Boost Hourly Rate 12.5c

Fringe payments by automotive parts manufacturers to hourly rated labor averaged more than 12.5 cents a hour over and above direct wages for every man-hour worked in 1947, according to Automotive & Aviation Parts Manufacturers, Inc. which is conducting a survey. Preliminary figures show that an employe working 2000 manhours a year would receive more than $245 for the so-called fringe benefits. The report points out that the figures are conservative, since they omit such legally required payments as old age and survivors insurance, workmen's compensation, and unemployment compensation. Also some of the companies said that the cost of certain fringe items cannot be determined. It was pointed out that the cost of pay for holidays not worked will increase substantially during 1948 since many companies did not agree to this provision until after one or more holidays had passed.

Supply Ford Foremen With Supervisory Manual

As a further step in its intensive program for improving employe relations Ford Motor Co. has compiled and distributed to each of its foremen at the Rouge plant a new manual covering all phases of the supervisor's duties and responsibilities. The manuals were presented personally at the training conference at which its contents were explained.

GM Labor Disputes Hit Low Mark in '47

Labor relations in GM plants last year were the best since the union won recognition in 1937. According to a company report, workers lost less than 0.03 per cent working time because of labor disputes. The average number of salaried and hourly-rated employes last year was 375,689, a peacetime high, compared with 303,837 in 1941, the highest previous peacetime year. Payrolls last year were at a peacetime record, totaling $1,155,388,163. Average weekly earnings of the 268,479 hourly rated workers in U. S. plants was $57.86.

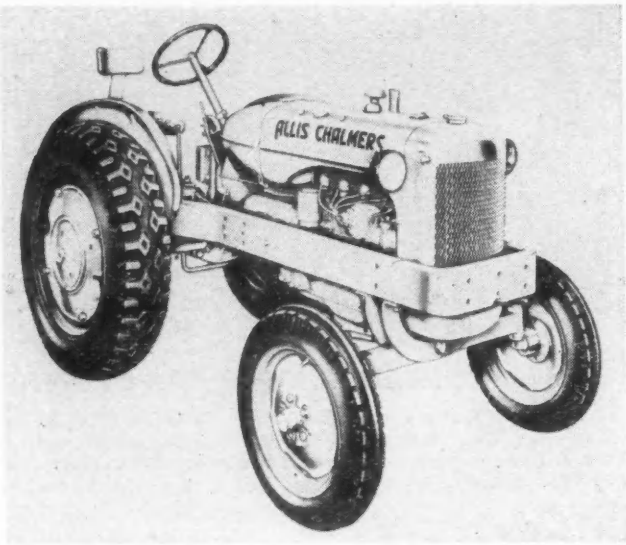
Ford Union Fights Loss of Paid Lunch Period

Ford Local 600 politics boiled up recently following a decision unfavorable to the union by the impartial umpire concerning paid lunch periods. The umpire ruled that the company was not required to continue payment for a 20-minute lunch period in the absence of any contract provision. The company immediately realigned schedules providing a half-hour unpaid lunch period and extending the work day by 30-minutes. Savings to Ford are estimated to be about $8 million a year. The union leaders immediately raised a hue and cry and have asked the International Union for permission to strike on the issue. Ford was the only company still continuing the paid lunch period instituted during the war, and the dispute was referred by mutual agreement to the impartial umpire during negotiations last summer.

NEWS *of the* AUTOMOTIVE INDUSTRIES

French Car Output up 30% in 1947

French automobile production increased 30 per cent and exports rose 50 per cent in 1947 compared with the previous 12 months. Figures show a total production of 137,222 units, of which 78,524 were exported. The total includes 66,277 passenger cars, 3318 buses or coaches, 66,784 trucks, 521 road tractors, and 322 special vehicles. With increased allocations of steel, higher production is expected for 1948, with the very optimistic prediction of 160,000 automobiles for the home market. With increased imports of crude from the Middle East, the gasoline situation is improving.



'48 ARRIVAL

Now in production, this new Allis-Chalmers' 1948 model IB wheel tractor is designed for municipal and industrial maintenance. Weighing 2365 lb, the new tractor, powered by a 16.3-hp engine, has a wheelbase of 57 7/16 in., a length of 97½ in., and ground clearance under the front axle of 8¾ in.

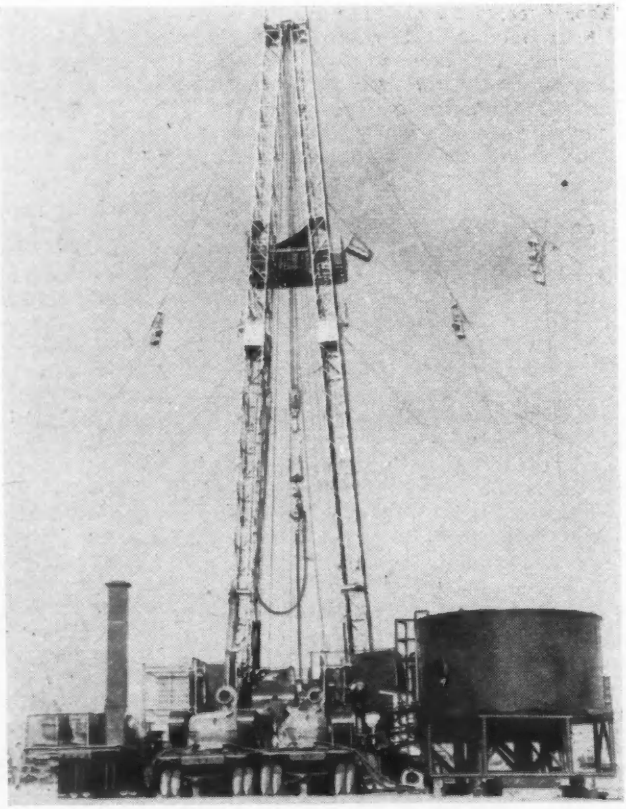
'48 Packards Feature New Ventilation System

Control of temperature and, indirectly, humidity in 1948 Packard cars is easier and more effective than it is in most American homes, according to Packard Motor Car Co. engineers. The company's full line of 1948 models is equipped with a built-in, hidden ventilation system which with the optional heater warms or cools every corner of the car and reportedly minimizes, even with all windows closed, dangerous vision-obscuring condensation in all seasons under all weather conditions. In winter, for example, the car need not be in motion for effective ventilation to take place.

The system is comprised of two five in. ducts, each independently controlled, leading from just inside the front grille to right and left-hand vents in the front passenger compartment. The duct on the right side of the car is connected with the thermostatically-controlled heater located under the hood. Hidden by the instrument panel, a specially-designed chamber receives warm air from the heater and circulates it evenly throughout the car.

PORTABLE DRILLING

Complete portability characterizes this new all-electric oil well drilling rig, recently placed into operation by the Shell Oil Co., Inc., near Ventura, Calif. Designed and built at a cost of $250,000, the unit features a twin-mast derrick, of 300,000-lb capacity, 123 ft in height, collapsing to 63 ft for truck and trailer hauling. Five Fruehauf trailers, of the seven wheeled components of the rig, are shown.



GM Records 1947 Net of $288 Million

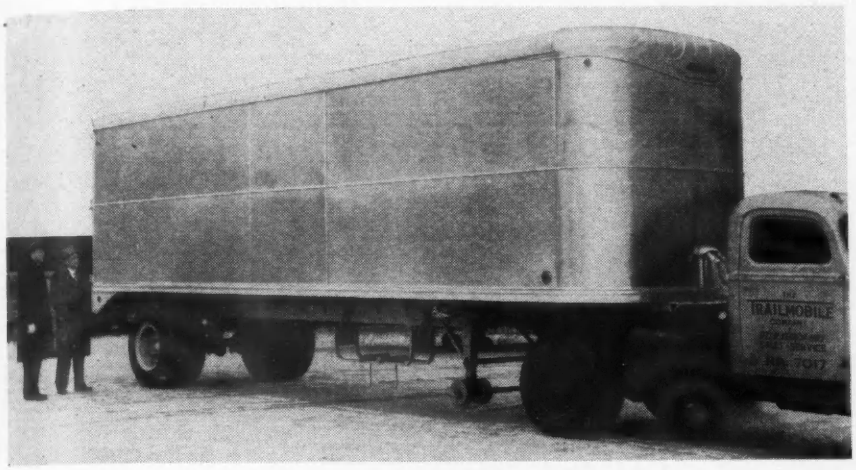
Banner peacetime automotive earnings and sales in 1947 seem to be the rule. With the final returns for 1947 for GM now in, record peacetime net sales of $3,815,159,163 for 1947, as compared to $1,962,502,289 for 1946 were recently announced. Net income for 1947 totaled $287,991,373 as against net income for 1946 of $87,526,311.

Unit sales of General Motors passenger cars to dealers in the United States and Canada and shipments overseas during 1947 totaled 1,503,046, compared with 848,690 in 1946, 1,864,067 in 1941 and a 1937-1941 average of 1,494,957. Sales of Chevrolet and GMC trucks in 1947 totaled 427,872, compared with 326,758 in 1946, 505,599 in 1941 and a 1937-1941 average of 337,509.

Hudson and Studebaker to Assemble in Mexico

Automobile assembly south of the border continues to boom with the announcement that Hudson and Studebaker will start assembly operations in Mexico. Assembly of three Hudson passenger car models will be started in April by Automotriz de Mexico, S.A., the Hudson distributor. Three warehouses in Mexico City, with an area of about 10,000 sq ft, will be converted into an assembly center by Servicio Studebaker, S. A. for truck and passenger car assembly. Currently, the list of cars being assembled in Mexico includes GM, Chrysler, Packard, Nash and Ford.

NEWS *of the* AUTOMOTIVE INDUSTRIES



TRAILBLAZING IN '48

The first of the Trailmobile Co.'s all-new products, the Trailblazer, shown above, is an aluminum-type trailer which is 700 lb lighter than the 28-ft single-axle steel panel model it replaces. Aluminum alloy is used in this trailer which also features a new Aeroloy wheel molded from high tensile aluminum. Every exposed ferrous metal part of the Trailblazer is factory-rustproofed.

Rikmobile to Replace Rickshaws

Designed to supplant man-drawn rickshaws in China, the Rikmobile, produced by the China Engineering Products Corp., San Francisco, is being shipped to China for experimental trials. A three-wheeled vehicle, weighing under 300 lb, it is powered by a one-cyl engine, and is reported to have a top speed of 35 mph.

Buick Expects to Make 300,000 Cars in 1948

Based upon the expectation that cold-rolled sheet and strip steel will be available in greater quantities in 1948, Harlow H. Curtice, Buick general manager and GM vice president, said recently that Buick hoped to build about 300,000 cars this year. Although Buick has expanded facilities to permit the production of over 500,000 cars a year, steel supply has been a major limiting factor. In 1947 Buick built 267,830 units.

New Methods in Ford's Rouge Foundry

The 1949 Ford and Mercury cars will have the highest quality V-8 engine blocks produced in Ford Motor Co.'s history because of new methods and controls established in the Rouge foundry, according to Mead L. Bricker, vice-president and director of general production. First of the projects to be completed in the Rouge foundry's $12 million postwar improvement program was rebuilding of the cylinder block production department. Working conditions were considerably improved, and properly engineered operations and scientific control guarantee a better product, Mr. Bricker said. Casting cooling lines and knockout vibrating lines have been rebuilt. Maintenance on molding reels was simplified and improved so that breakdowns on these units are now at a minimum. Mechanical metal handling equipment was installed to assure better handling of more than a thousand tons of metal necessary each day for maximum cylinder block production.

Studebaker '47 Net Over $9 Million

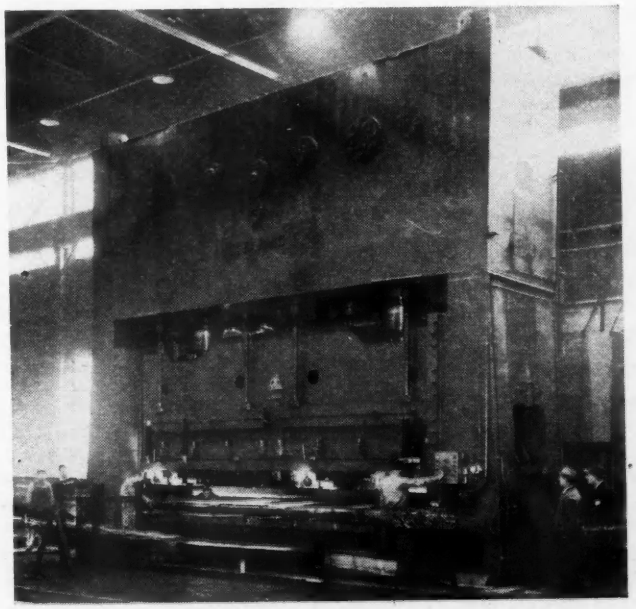
A new peacetime sales record was set by Studebaker Corp. and its subsidiaries in 1947 when sales totaled $267,998,838, as compared with $141,564,321 in 1946. A consolidated net profit of $9,127,103, after all charges and taxes, was reported for 1947 as contrasted with a net profit in 1946 of $948,808, after a tax carryback credit of $9,093,000.

GM's Fisher Body Expands Experimental Section

A vast expansion of the GM Fisher Body Div. experimental and development section, accomplished since the close of the war, was disclosed recently by L. C. Goad, vice-president of GM and general manager of its automobile body-building division. Personnel of the department now numbers about 200, while approximately 80,000 sq ft of floor space in one of the several Fisher Body plants in Detroit is being devoted to its operation.

Rootes to Boost Exports of Cars to U.S.

The latest British entry to invade the American market, the Rootes Group, recently announced plans to export 3000 to 4000 of its Hillman Minx and Commer automobiles to the U. S. in 1948.



HUGEST YET

Towering 43 ft. 10 in. above its subfloor base, this press, reportedly of the largest design ever built for automotive parts manufacture, was built by the Clearing Machine Corp., Chicago, and recently went into operation at the Cleveland plant of Midland Steel Products Co. This machine is capable of exerting a ram force of six million lb of eight strokes per min. Both 33-ft. steel side rails for the frames of the largest buses, trucks and trailers can be stamped out simultaneously.

NEWS *of the* AUTOMOTIVE INDUSTRIES

SKY VAGABOND

Now rolling off the assembly line, this new Piper PA-15 Vagabond, powered by a 65-hp Lycoming engine, is priced at $1990, faf, Lock Haven, Pa. With a top speed of 102 mph, the Vagabond's wing span is 29 ft, 3⅛ in.; length is 18 ft, eight in.; and height is five ft, 11½ in.

Piper to Start Output Of PA-14 Family Cruiser

To go into production shortly, the new de luxe Piper PA-14 Family Cruiser is to be priced at $3825, faf, Lock Haven, Pa., the Piper Aircraft Corp. recently disclosed. Powered by a Lycoming O-235-Cl engine rated at 108 hp, the Family Cruiser has a top speed of 123 mph. It has a wing span of 35 ft, 5½ in; length of 23 ft, 2½ in; and height of six ft, five in.

Auto-Lite's '47 Sales $186 Million

Reaching an all-time peak, net sales of the Electric Auto-Lite Co. totaled $186 million in 1947, compared to $122 million in 1946. Net earnings after taxes amounted to $10,714,986 in 1947 as compared to $4,071,609 in 1946. Royce G. Martin, president, also announced that following the end of the war, Auto-Lite began an expansion program which has now resulted in increasing the number of its American and Canadian plants, in operation or soon to be utilized, from 20 to 29, with an increase in area from four million sq ft to 7.5 million sq ft.

Fraser Named Chairman of Automotive Safety Body

Paul G. Hoffman, president, the Studebaker Corp., recently resigned as chairman and treasurer of the Automotive Safety Foundation. He will be succeeded in the chairmanship by Alexander Fraser, president, Shell Union Oil Corp. A. O. Dietz, president, Commercial Investment Trust Inc., was named treasurer, and two new vice chairmen were elected: B. E. Hutchinson, chairman, Finance Committee, Chrysler Corp., for the motor vehicle manufacturers; and Dr. Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana), for the oil industry.

Paul Hoffman Sees Orders Unfilled Through '49

Although there is a general belief that the automobile industry will catch up to demand in all but the lower priced lines this year, Paul G. Hoffman, president of Studebaker, said recently that the industry will not catch up with the demand all through 1949, particularly in the popular car field. He said that a third round of wage increases amounting to 15 per cent would raise the average production cost per car about $75, of which a large part would have to be passed on to the customer.

K-F Trains Union Stewards in Time-Study

Kaiser-Frazer Corp. has put into effect a new plan for working out production standards at its Detroit Engine plant. Under the new arrangement, grievances concerning time standards are handled through time study stewards who have been specially trained for the job. Nine union members were selected through competitive tests for two weeks special training in time study under an independent firm of engineering consultants. Eight company time study men took the same training course. The three union members who finished highest in the course now devote full time to their new work and receive the same pay as company men.

B-50'S TRANSPORT TWIN

Transport counterpart of the Boeing B-50, the U. S. Air Force's standard long range bomber, this new Boeing YC-97 A Stratofreighter, recently flown for the first time, is powered by four 3500-hp Pratt & Whitney engines. With range and speed similar to the B-50, it will carry 20 tons of cargo for 134 fully-equipped troops.

More Space for GM Plant in South Africa by Summer

Expected to be completed by this summer, an extension to GM's assembly plant in Port Elizabeth, Union of South Africa, will add approximately 360,000 sq ft, and permit the assembly of 35,000 cars and trucks a year. The extension is said to cost $4 million.

NEWS *of the* AUTOMOTIVE INDUSTRIES

Personal Aircraft Exports Totaled 43 in Feb.

A total of 43 personal aircraft, four place and under, valued at $219,471 was exported in February by the 11 companies reporting to the Aircraft Industries Association.

Price Drop May Help Car Market

Automobile company economists have had little public comment on the effect of the drop in commodity prices on the automobile market. The general belief, however, is that a major price decline for food might increase demand for the lower priced lines since consumers would have more money left for purchase of automobiles. However, the effect on the farm market will depend upon how far prices decline. It is believed that the farmers generally are in excellent financial condition and have been counted on to hold up demand for automobiles for a considerable period. The general opinion is that unless there is a sustained and much more severe drop in farm prices, the rural market will remain strong.

Award $5.5 Million USAF Contract to Northrop

A $5.5 million U. S. Air Force contract has been awarded to Northrop Aircraft, Inc., Hawthorne, Calif., for the manufacture of 23 three-engined assault transports, military versions of the Northrop-Pioneer.

Portsmouth Gets Coal Co. in Kentucky

The Portsmouth Steel Co., 15 per cent of which is owned by the Kaiser-Frazer Corp., has acquired the coal operations of the Tierney Mining Co. at Stone, Ky. A considerable area of undeveloped coal lands and a mine were included in the transaction.

Texaco Grants Licenses to Make Synthetic Gasoline

Texaco Development Corp. is now prepared to license anyone within the petroleum industry to manufacture synthetic gasolines by means of the Hydrocol Process, according to W. M. Stratford, president. The new process, Mr. Stratford said, resulted from the joint and continuing research efforts of Hydrocarbon Research, Inc. and The Texas Co.

It is this process which will go into operation on a large commercial scale early in 1949 at the Hydrocol plant at Brownsville, Tex. and at the Stanolind plant at Hugoton, Kan. Each of these plants, when completed will produce more than 300,000 gallons a day of synthetic gasoline. According to Mr. Kemp, director of research for the Texas Co., this company has been doing research and development work in this field for more than ten years, and the making of synthetic fuels has become of major significance, involving more than one fourth of the company's entire research program. Currently, some 12 pilot units are being operated on various phases of the expanding project. These range from small "bench model" units at the company's center for fundamental research at Beacon, N. Y., to large semi-commercial units at Montebello, Calif.

Monroe Forms Two Foreign Subsidiaries

The formation of two foreign manufacturing subsidiaries to expand the sale of Monroe hydraulic shock absorbers in world-wide markets was announced recently by Brouwer D. McIntyre, president and general manager, Monroe Auto Equipment Co. The two subsidiaries, which are expected to attain a combined production of more than 5000 shock absorbers a day, are Monroe-Acme, Ltd., Toronto, Canada, established by Monroe, and the Canadian-Acme Screw & Gear, Ltd., Toronto, and Woodhead-Monroe Ltd., Leeds, England, formed by Monroe and Woodhead Components, Ltd. In addition, Mr. McIntyre revealed that Monroe has developed its affiliations with Chrysler-Dodge Distributors, Adelaide, Australia, now in production of Monroe-designed shock absorbers, and Premier Automobiles, Ltd., Bombay, India, soon to begin manufacturing activities.

von Karman to Receive '48 John Fritz Medal

Dr. Theodore von Karman, aeronautical engineer, has been selected to receive the 1948 John Fritz Medal for scientific achievement. The medal will be presented by the American Society of Mechanical Engineers when von Karman, who is now in Europe, returns to this country.

NLRB Bars Foremen From Workers Union

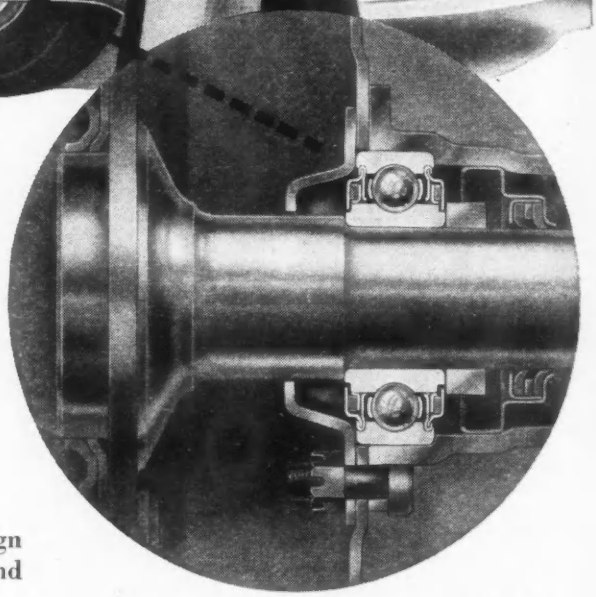
NLRB has set an important precedent in ruling that employers have the right to demand that employes withdraw from production unions before being promoted to foremen. The decision was handed down in a case dismissing unfair labor charges against a West Coast employer who ordered two employes to withdraw from the Longshoremens and Warehousemens Union (CIO) before their promotion to foremen. The board said "Conflicting obligations imposed upon a foreman by his position with the employer and by his obligations to his union create real and present damages to the company, the union, and the foreman himself."

(*Turn to page* 82, *please*)

DELUXE TRAVELING

Seating passengers on two levels, the Highway Traveler, a new deluxe compartment coach recently announced by the Greyhound Corp. incorporates two Firestone Tire and Rubber Co. developments: Wire Cord tires and a new crash-proof gasoline tank. This coach is also equipped with special Goodyear All-weather tread Nylon tires.

Built to be Forgotten



More leading cars change to self-sealed rear wheel ball bearings

Here's an advancement in motor car design that works faithfully for your pleasure and profit—while you forget it!

This New Departure Rear Wheel Ball Bearing

- is proof against neglect or wrong lubrication—because it's self-sealed and lubricated for life!
- no abrasive dirt can get in to cause looseness or shorten its life.
- no grease can escape to cause slipping brakes.
- no bearing adjustment for wear—*ever!*
- it's service free—it's *built to be forgotten!*

Over a million new 1948 cars will roll easier—smoother—on New Departure sealed-for-life rear wheel bearings! Will yours?

Proved by 14 years and billions of miles in actual service.

nothing rolls like a ball . . .

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13

Way Opened for Entry of British Cars into Canada

Although Embargo Is Lifted, Imports of American-Made Vehicles Are to Be Held to 16 Per Cent of Yearly Dollar Volume. British Quota Nearly Four Times Greater.

Special to AUTOMOTIVE INDUSTRIES

OTTAWA—New government regulations announced here for 1948 will cut Canadian imports of American new passenger cars and trucks to 16 per cent of the preceding annual dollar volume. This means that $62,000,000 worth of vehicles previously imported from the United States will be slashed by something like 84 per cent and the way opened for the entry of British-made cars into the Canadian market. It was also learned from official sources that the effect of the regulations wil be to reduce the $100,000,000 volume of imported parts and accessories by about 25 per cent annually. Used cars and trucks continue under the embargo that began November 18.

Canadians never showed much enthusiasm for British cars, but if British manufacturers can meet competitive prices, they are assured of rapid sales as a heavy demand now prevails for new cars. As this is being written the Canadian government announces that under the new quota system Great Britain can ship to Canada this year $7,500,000 worth of new cars as compared with $2,000,000 last year. This quota for Britain became effective March 1.

Now that the embargo on new vehicles has been lifted and importers of American cars are provided with a dollar pool for their imports, the tendency will be towards bringing in low-priced and medium-priced cars, thus eliminating those in the higher-price brackets. New and used vehicles imported in 1947 by Canada from the United States consisted of 33,801 cars and 11,418 trucks, buses and chassis.

The basis on which imports of complete new automobiles will be permitted this year is that each importer will be given a dollar allotment determined by the number of passenger cars and trucks he imported from the so-called "scheduled" countries during the twelve months ended Oct. 31, 1947. The dollar allotment will be arrived at by multiplying the number of units imported during the basic period by $230, a figure which is calculated to be 75 per cent of the average foreign currency content of automobiles manufactured in Canada. Thus an importer who imported 1000 vehicles during the basic period would be entitled to a dollar allotment of 1000 x $230, or $230,000, with which to purchase and import cars and trucks from the scheduled countries during 1948.

The dollar allotments will apply to complete passenger cars with a seating capacity of 10 persons or less, and to trucks having a manufacturer's gross vehicle weight rating of less than 16,501 lb. Passenger buses and heavy trucks are not included, and applications for their importation will be considered individually on their merits.

Application forms for imports from scheduled countries may be obtained from Collectors of Customs in the larger centers in Canada. Forms may also be obtained from the Capital Goods Emergency Import Control Division of the Department of Reconstruction and Supply in Ottawa, with whom all completed applications should be filed.

This Division will also handle requests for the individual permits which are required for imports form non-scheduled countries with respect to each shipment. The scheduled countries are Cuba, the Dominican Republic, Guatemala, Haiti, Panama, El Salvador, Switzerland, Union of Soviet Socialist Republics, the United States of America and its possessions, and Venezuela.

Parts and Accessories

New regulations, effective as of March 1, governing the import of automobile parts and accessories under Tariff Items 438b, 438c, 438d, and 438e, were announced as a further measure to conserve Canada's foreign exchange. Their general intent is to allow manufacturers and importers to obtain dollar allotments covering imports from the so-called scheduled countries, in a percentage ratio to the dollar value of parts and accessories which they imported from those countries during the 12 months ending Oct. 31, 1947, which is known as the basic period. Imports from non-scheduled countries will require individual permits, which will be issued within certain designated limits. An incentive is provided for manufacturers to increase their exports by permitting them an added percentage of imports from the scheduled countries

(*Turn to page 54, please*)

TABLE I

PRINCIPAL APPLICATIONS OF CONSTRUCTIONAL ALLOY STEELS PASSENGER CAR, TRUCK AND FARM EQUIPMENT

Industries	Passenger Car, Light Truck, Tractor						Heavy Truck	Diesel Engine
Applications	Arms and Knuckles		Axles and Shafts		Universal Joints	Sway Eliminator Bars	Crank Shafts	Crank Shafts
Tensile Strength Range (psi)	125,000 to 165,000	150,000 to 200,000	150,000 to 200,000	175,000 to 225,000	125,000 to 175,000 (Core)	140,000 to 170,000	140,000 to 170,000	100,000 to 125,000
Mn	1340		1330	1340				
Ni-Cr	3130–35–40		3140–45					
Mo	4047–53		4063–68			4068		
Cr-Mo	4135–42		4140–45–50			4140	4142	
Ni-Cr-Mo		4337–40		4340–45	4317–20		4340	
	8640–42		8640–50	8653	8720			
	8740–42	9840	8740–50	9840–45				
Ni-Mo			4640		4617–20			
Cr						5145	5145	5046 5145

Latest Uses of Alloy Steels in

By M. J. Day,
Ass't Metallurgical Engineer—Alloy Steels
Carnegie-Illinois Steel Corp.

VARIOUS types of chromium and nickel steels were first used in the automotive field around 1900. These served as the basis for standardization of the 2300 and 2500 series nickel steels and the 3100, 3200, 3300 and 3400 series chromium-nickel steels when the mechanical division of the Association of Licensed Automobile Manufacturers was revised and incorporated into a division of the Society of Automotive Engineers, Inc. The French manganese-silicon spring steels, now known as the 9200 series steels, were first used in the country about 1910. Ford, Pope-Hartford and Pierce Arrow cars were among the first to include alloy steel parts, but not in any great amount.

About 1914, through the efforts of John Wandersee of the Ford Motor Co. to reduce the weight of the automobile from "3000 lb to about 1500 lb," the steel industry succeeded in making chromium-vanadium steel in the basic open hearth furnace, and Ford adopted its use. He was able to achieve his purpose, namely, effecting the desired weight saving, through improved design and the use of high strength materials. This is the basis of the countless applications of alloy steels today.

Dodge Motor Car very soon after this adopted chromium-vanadium steels for gears and 3100 series chromium-nickel steels for other parts. Many manufacturers then predicted that high production chromium-vanadium steels could not be handled as well as the older nickel or chromium-nickel steels could, but both the Ford and Dodge companies demonstrated that the new steels had great possibilities.

About 1922, C. H. Wills introduced the chromium-molybdenum steels, now known as the 4100 series, in his Wills St. Clair automobile. In 1915, R. B. Schenck, Chief Metallurgist of the Buick Motor Co., developed the carbon-manganese series of steels for use in steering knuckles and arms. These steels are now the 1300 series and their use has expanded to include axle shafts and other important applications.

Between 1925 and 1930 the nickel-molybdenum steels now classed as the 4600 series came into being, finding use in gear applications at the Studebaker Corp. plant. By that time Chevrolet had adopted 6100 series steels (chromium-vanadium) for gears and nickel and chromium-nickel steels for other parts. Investigation continued, however, and soon what is now the 4800 series was developed for differential gears. Somewhat later nickel-molybdenum steel, now the 4600 series, came into use for other gear parts. By 1930 the nickel-molybdenum series had practically displaced chromium-vanadium, nickel, chromium-nickel, and the 3½ per cent nickel gear steels throughout the entire automotive industry.

Carbon-molybdenum steels, now classed as the 4000 series, came into prominence at Chrysler Motors in 1933, and about the same time chromium-nickel-molybdenum (now 4320) steel was introduced at Timken-Detroit Axle Co. and Spicer Manufacturing Co. In cooperation with E. O. Mann of Chevrolet, Carnegie-Illinois Steel Corp. developed the low chromium-nickel 3000 series steels, and a low chromium-nickel-molybdenum steel, which was a modified 3100 chromium-nickel steel with molybdenum, referred to

TABLE II

PRINCIPAL APPLICATIONS OF CONSTRUCTIONAL ALLOY STEELS PASSENGER CAR, TRUCK, AND FARM IMPLEMENT (Cont'd)

Applications	Steering Worm and Sectors		Overdrive Cases	Piston Pin Bushings	Intake Valves	Pump Shafts	Countershaft and Other Pins	
Tensile Strength Range (psi)	115,000 to 160,000 (Core)	175,000 to 250,000	150,000 to 190,000 (Core)	115,000 to 160,000 (Core)	125,000 to 160,000	125,000 to 160,000 (Core)	125,000 to 160,000 (Core)	175,000 to 240,000
Ni-Cr					3140			4130-4140
Cr-Mo					4140			
Ni-Mo	4620					4620	4620	
Mo			4820				4027-4032	
Cr	5120	5132-35		5120			5120	5135-40
Cr-V				6120				
Ni-Cr-Mo	8620						8620	
	8720				8740			
Cr-Mo-Al						Nitralloy		

Motor Vehicles

as 4200 steel, was developed for Saginaw Steering Gear Co. Chevrolet, through E. O. Mann, also developed and adopted the 5000 series of low chromium steels, which were a modification of the present 5100 chromium steel series.

Between 1935 and 1940, every effort was made to standardize constructional alloy steels, and through the efforts of the American Iron and Steel Institute the list of some 4000 alloy steel specifications was reduced to about 100, which met with the approval of the Society of Automotive Engineers.

Engineers generally design to meet weight and space requirements, particularly in the automobile and aircraft industries. As weight and space are restricted, the design requires unit stress increases and greater wear resistance. As a result, alloy steels are becoming increasingly popular, although the amount used in any single unit is relatively small, being, for example, about 400 lb in an automobile.

The end use requirements affect the kind and amount of alloying elements needed in a steel. The design of the part, in line with its weight and the space allotted to it; the stresses it must sustain with safety and long life; the size of section involved; all these factors influence the choice of a steel and whether one or more alloying elements would result in the most desirable properties in the steel finally selected.

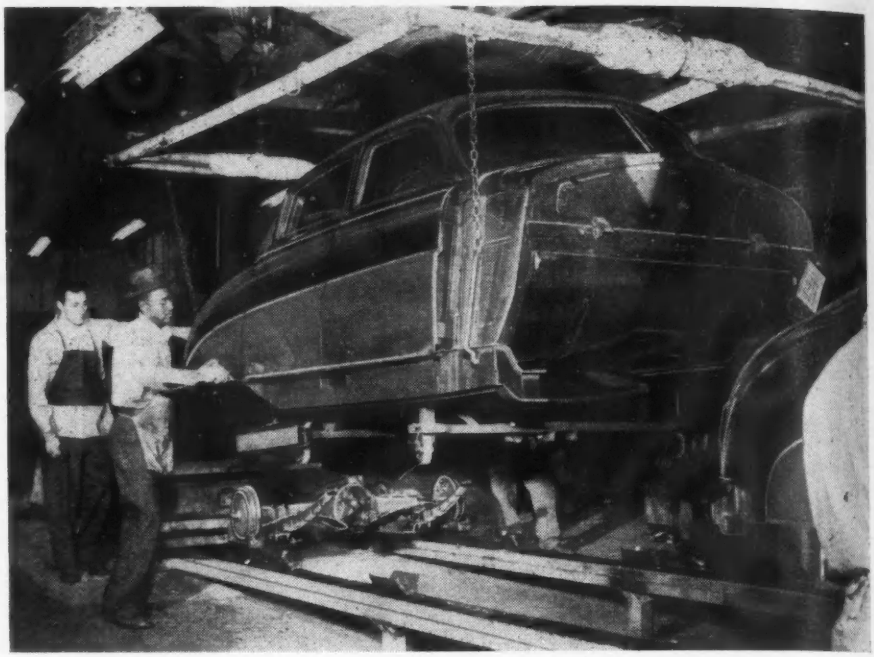
(*Turn to page* 58, *please*)

TABLE III

PRINCIPAL APPLICATIONS OF CONSTRUCTIONAL ALLOY STEELS IN TRUCK, TRACTOR AND BUS GEARS

Industry	Heavy Passenger Cars, Light Trucks, Tractors				Heavy Trucks, Heavy Tractors and Buses	
Tensile Range (psi)	110,000 to 150,000	150,000 to 200,000	250,000 to 300,000		110,000 to 150,000	150,000 to 200,000
Heat Treatment	A	A	B	C	A	A
Mn	1320		1340			
Ni				2340-45	2317	
					2512	2515-17
Ni-Cr						3310-16
Mo	4023-27-32					
Cr-Mo			4140	4140-45		
Ni-Cr-Mo		4340	4340	4340		4320
	8615-20		8640	8640-45-50	8620	
	8720		8740	8740-45-50	8720	
		SuperKore B	9840			
		SuperKore C				SuperKore AA
						SuperKore B
						SuperKore C
Ni-Mo	4620	4815			4620	4820
Cr	5120		5135-40-45			

Heat Treatments:
(A) Either (1. Carburize and oil quench from carburizing heat followed by a temper at 275/375 F.
(2. Carburize, air or retarded cool followed by reheating to a temperature of 1450/1550 F. oil quenching and tempering at 275/375 F. This treatment is used to minimize distortion.
(B) Heated to quenching temperature in a cyanide bath (to obtain a shallow case) followed by oil quenching and tempering at 350/450 F.
C) Oil quenched and tempered to obtain desired properties.



This is the start of final assembly operations with view taken just before the body as received from the body division is lifted onto the high-level conveyor. At this point the previously-prepared rear axle and suspension sub-assembly comes up from the floor below to meet the body. Note the "paint sticks" with their casters attached to the body to facilitate movement on the conveyor until the wheels are mounted.

Hudson Final Assembly Layout Quite Different Than Others

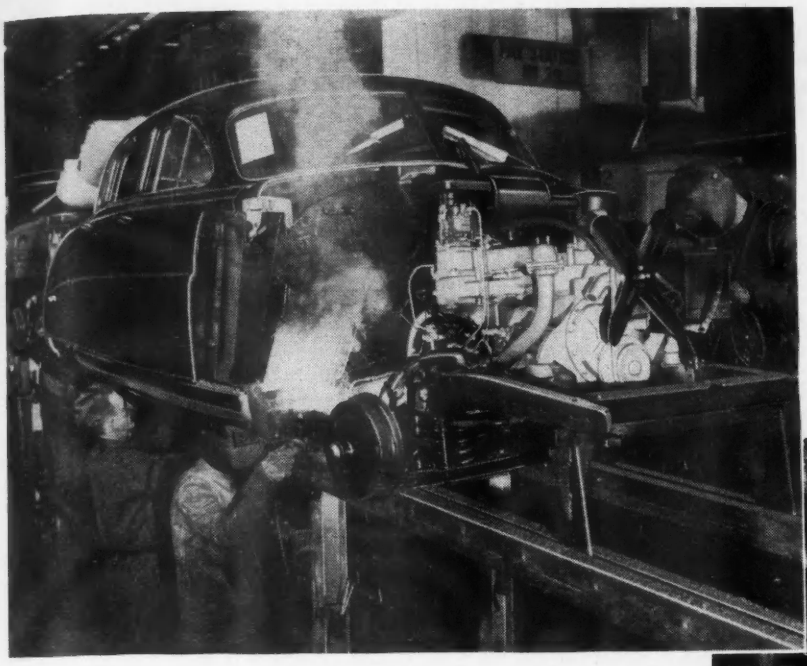
By Joseph Geschelin

WITH the introduction of its new Monobilt body—a structure combining the body and frame in an integral unit—Hudson found it necessary to develop special techniques for the fabrication of the body and to make a complete revision of its final car-assembly procedures. While leading motor car producers have made changes in final car assembly procedures at various times to conform with changes in body design and in keeping with accelerated schedules; Hudson has created a layout that is quite different from anything that may be seen in current practice. While this setup stems mainly from the radical change in body construction, some of its features have been dictated, necessarily, by the layout of the plant since it had to be fitted within an existing multiple-story building.

First of the assembly operations, approximately in order of precedence, is the block testing of the six and eight-cylinder engines in the motor department. As engines are accepted, they are loaded into special factory trucks and delivered to the assembly building. Here they are picked off according to the teletype schedule and fitted with the proper transmission; then placed on a conveyor for transport to the second floor where they meet the front chassis assembly line. The finished chassis subsequently is riveted and welded to the body assembly.

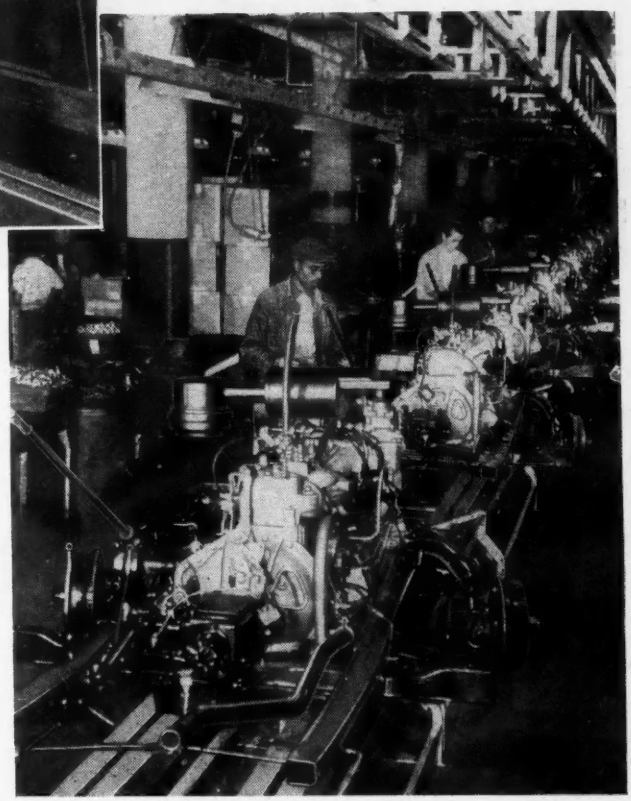
The front chassis assembly, integrated on two parallel conveyors, comprises the front suspension system, steering gear and column, battery and cradle, and other related items. As the lines approach their terminal end, the power plant assembly prepared on the lower floor is installed at the motor drop to complete this sub-assembly. Continuing on the conveyor the finished sub-assembly moves through two paint spray booths where the power plant is given the characteristic Hudson aluminum coating while the frame and other parts are finished in black. Then the units are held ready to hoist to the drop on the next floor where they meet the final assembly line. Meanwhile another sub-assembly line is preparing, simultaneously, the sub-assembly of the rear axle, rear springs, and shock absorbers. This marks the first major sub-assembly to be attached to the body structure.

At the first station of the final assembly line, painted bodies, as received from the Hudson body division, are fed one by one onto a high-mounted conveyor line to facilitate the necessary assembly operations at the lower edges and underside of the body. The rear axle sub-assembly moves on a conveyor through an open-



(Left) The next major sub-assembly attachment completes the backbone of the new car. On this section of the high-level conveyor line, the front chassis assembly with the front frame section meet the previously-prepared car assembly. At the preceding station the front section was attached to the body framing by fastenings. Here the joints between the front section and the main frame are welded permanently.

View of the assembly line for preparing in the rear axle and rear suspension system as an integral unit for mounting on the body structure



ing in the floor, and the body assembly is lowered onto this assembly.

Hudson is continuing its practice of installing "paint sticks"—structural members with casters at each end to facilitate movement of the body. Two of these are fitted underneath the body and serve to roll the body while moving on the assembly conveyors and until the wheels are installed. Also, it is interesting to note that an installation of the Bull-Dog Trol-E-Duct, carrying power for the various portable tools used on the assembly lines, is mounted directly to the conveyor side rails on each side.

The initial run of assembly described above continues for a considerable distance to permit the installation of a variety of running gear parts and side moldings. The elevated section of conveyor permits the completion of attachments at the sides and rear and underbody, leaving the front end still open. At the end of the elevated conveyor, the assembly is transferred to floor level, and then runs on a power driven floor chain conveyor. Here is an extensive line for the installation of body trim, interior and exterior hardware, wiring. This portion of the final assembly line handles the manifold operations usually done in the conventional body shop.

At the end of the trim line the body is hoisted upward and then lowered on to the front chassis assembly which has previously been placed on a high level conveyor line to permit the joining of these two major components. After being directed into place, the front chassis assembly is joined to the body, first, by four rivets at each side of the front end by cold squeezing with a hydraulic squeezer and attached by fastenings at the rear end. After completion of fastening, which assures alignment, the front frame members are joined permanently to the body frame members by arc welding. This is all accomplished on a moving conveyor.

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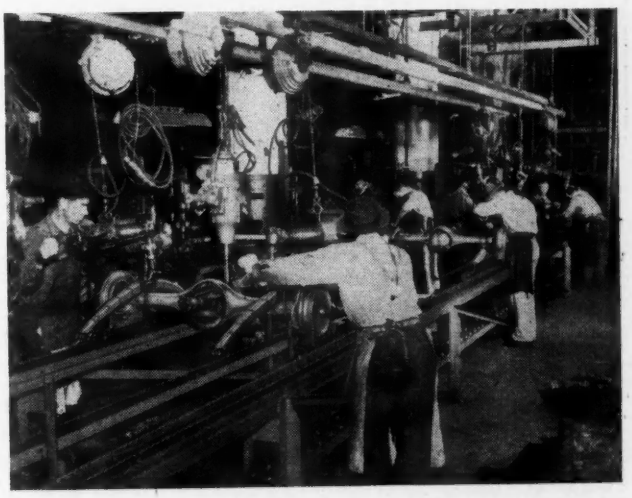
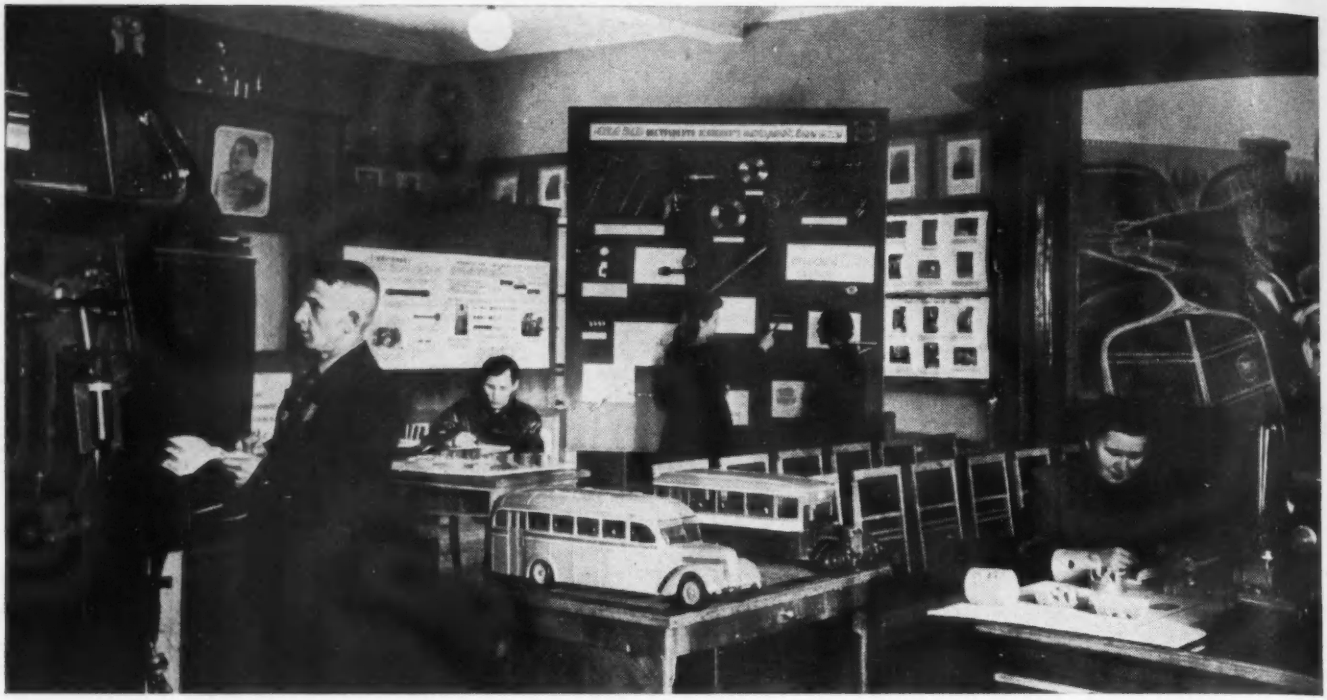


The major sub-assemblies are prepared on individual lines on the floor below the final car assembly lines. This is a perspective of the front chassis assembly line. Here the power plant, front suspension, battery, exhaust pipe and other items including the battery, are assembled onto the front frame section.



A study hall in the Stalin Automobile Plant Palace of Culture for investigating the latest developments in automobile design. (Photo by Sovfoto)

The Automobile Industry That's Behind the Iron Curtain

By D. B. Shimkin, Ph.D.

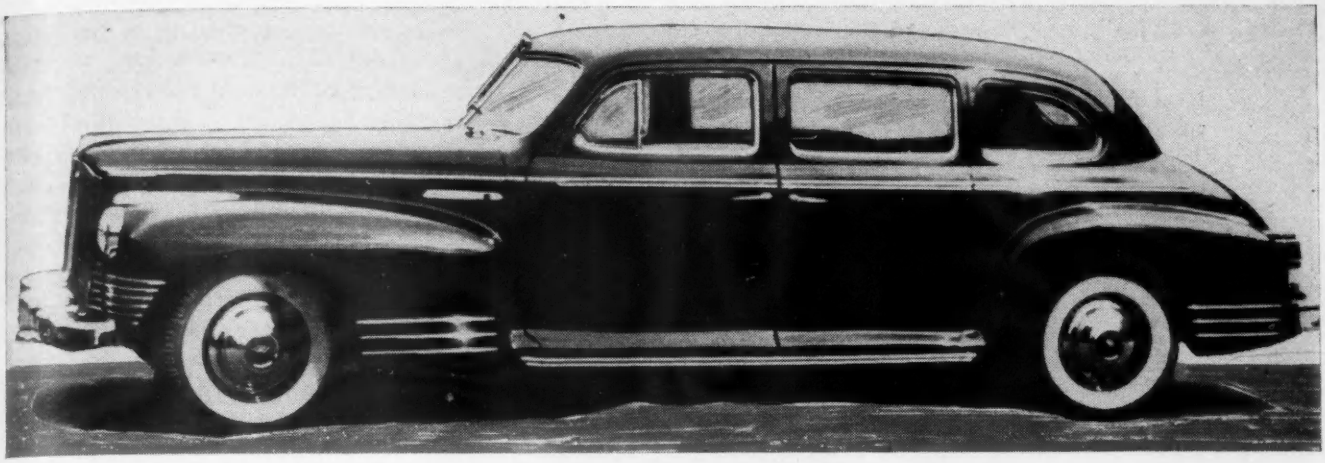
Part III— Research and Development of Russian Motor Vehicles

Part II was published in the Feb. 15 issue of AUTOMOTIVE INDUSTRIES

SOVIET investigations in the automobile field have been seriously hampered by lack of facilities, inadequate numbers of researchers, compartmentation and—all too often—immature research techniques.

So far as is known, only six motor vehicle research centers other than those maintained by the armed forces are active in the USSR. The two oldest are the Scientific Auto-Tractor Institute (NATI) with laboratories testing transmissions, pneumatic equipment, steering gears, suspensions, brakes, bodies and cross-country performance; and the Scientific Motor-Vehicle and Engine Institute (NAMI) which is devoted largely to engine research. Both of these date to the early 1920's. In addition, GAZ and ZIS have had experimental divisions, largely engaged in metallurgical studies. Since 1940, the Central Scientific Research Institute of Automobile Transportation of the RSFSR (Russian Republic) or TsNIIAT, has been interested in broader problems. Its limited facilities have, however, sharply curtailed the scope and quality of research possible. It has only three laboratories: automobile, measuring devices, and fuel and lubricants. The last of these is not equipped for fundamental research. The Automobile Laboratory of the Academy of Sciences apparently engages largely in economic planning. Finally, a seventh center should become active when the Institute of Automobile Technology (Orgavtoprom) acquires its own laboratories. No automobile proving ground exists in the USSR. In all, it is doubtful whether 500 trained scientists, engineers, technicians and assistants—excluding those in the armed forces—are engaged in regular motor vehicle research in the entire Soviet Union.

Extreme compartmentation of research, caused probably by a combination of jealousy of its prerogatives on the part of each administrative division, rigid allocation of funds, and narrowness of technical train-



CARS FOR THE COMMISARS

Today in communist Russia luxury cars are for the commisars and other select party officials. The above photo shows a ZIS-110 belonging to the Soviet ambassador in London. This model is built at the Stalin factory in Moscow and is powered by a copy of Packard engine. In Russia's pre-communist days only royalists rode in limousines.

ing, has aggravated the effects of insufficient facilities, personnel and funds. Such compartmentation is evident in two basic ways. On the one hand, the approach to many basic problems has been extremely narrow. For example, the Soviet justification for large-scale development of gas-producer vehicles has been based on the shortage of gasoline and the difficulty of its adequate distribution with a general lack of pipelines and an overloaded railroad network. The loss of tractive power, the excessive use of scarce metal, the wastage of timber resources, the extra manpower required, and the irregularity of operation which result from the use of such an inefficient fuel have never been considered. The cost of such waste as opposed to the investment required for proper development of refining and distribution capacity, synthetic fuels or genuine multi-fuel engines seems never to have been analyzed. In general, in this problem as in many others, emphasis has rested upon simple expedients that will produce some results rather than upon broader, more difficult, but more fundamental solutions.

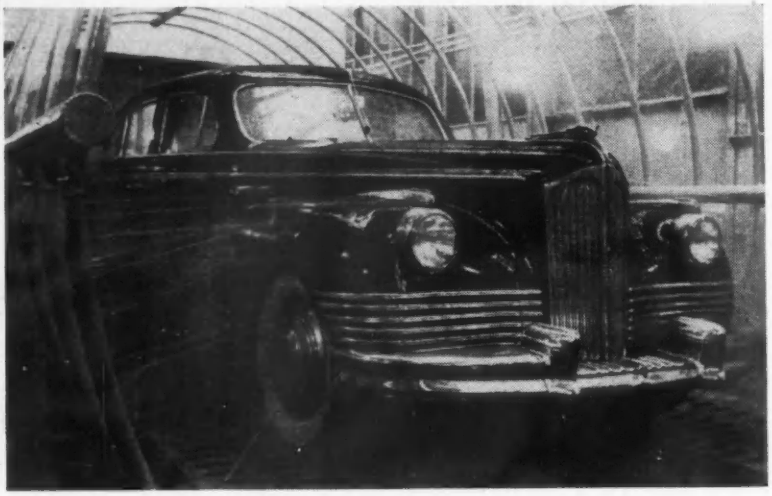
On the other hand, a strong tendency toward schematicism and a purely armchair approach exists. For instance, Soviet researchers have expended great efforts in building up hypothetical, nation-wide norms for maintenance and repair intervals. Yet actual investigations of specific operating problems, driver proficiency and repair and maintenance practices in various motor pools and shops have been virtually nonexistent. The vast area of fallow research of this type in the USSR is illuminated by the results of the few field studies that have been made. As an illustration, Kolesnikov and Kucherov examined maintenance procedures in Moscow garages in 1939. They found that "Moscow garages do not use set rules in regulating carburetors. Each garage has its 'own' method of regulation. Each mechanic is left to shift for himself, as the technical heads (of the garages) do not interest themselves in the method of regulating carburetors. Factory methods of regulation are unknown in most garages."

Because of the combination of adverse factors discussed above, it is scarcely surprising that Soviet motor vehicle research and development prior to World War II achieved no significant results. Real motor vehicle research and development in the USSR thus began only when the pressure of the war made the accomplishment of results imperative. The first basic work—and the most important to date—was the testing of Lend-Lease vehicles to examine their operating problems, to increase their service life, and to gain information for future Soviet designs. This program and its results are thoroughly presented in the fundamental volume by A. A. Krzhivitskii, S. B. Chistozvonov and M. I. Briskin: "Importnye Avtomobili, Modelei 1941-43 gg." (Imported Motor Vehicles, Models 1941-43), Moscow, 1945. Subsequent work in the postwar period has centered on the oconomics of automobile transportation, economy of gasoline, garage equipment and automotive repair, engine wear, gas-powered vehicles and metallurgy.

Soviet Tests of Lend-Lease Vehicles

Between July 18, 1942, and May 15, 1943, the Scientific Auto-Tractor Institute (NATI) and the Red Army maintained a special Transport Co. in the Communications Zone near Moscow. This company operated 69 Lend-Lease vehicles of 14 makes, and utilized the standard operating procedures and preventive maintenance of the Red Army. The personnel of this company were reinforced by supervising teams of engineers and technicians, who enforced sound operating methods, checked performance minutely, measured engine wear with micrometers, etc. The special operating problems which this group encountered were convoy operation, poor roads (57 per cent unpaved); severe winter conditions with low temperatures and heavy snow; mud; extremely poor, variable-quality gasoline and oil; and lack of spare parts such as main bearings.

By the end of the test period, poor fuel and lubricants had knocked out nearly 50 per cent of the engines, and had seriously lowered the performance of



A ZIS-110 in the shower test room.

all but the heaviest trucks (Fig. 1). Even such drastic expedients as complete oil changes every 500 to 600 miles proved to be ineffective under the conditions of operation. Thus the field tests failed to give absolutely conclusive results on the quality of Lend-Lease vehicles.

Consequently, the field tests were supplemented by individual vehicle tests and by stand tests at Moscow. The net result was a comprehensive evaluation of the performance, outstanding qualities and defects of U. S. and British trucks under conditions of the USSR.

Soviet Critique of Lend-Lease Vehicles

(1) U. S. and British Lend-Lease vehicles are highly developed models, but not a single one of them as a whole nor its engine as a whole is fully suitable for operation in cold Soviet climates.

(2) The large number of engine breakdowns suffered by these vehicles cannot be attributed exclusively to poor Soviet fuel lubricants. In part, it derives from qualities suitable for the U. S. and Britain but not the USSR: the basic defects of the Lend-Lease vehicles are insufficient attention to easy servicing and insufficient attention to winter starting problems. While the suspension on military trucks was excellent, that on commercial trucks was unsatisfactory, especially in regard to wheel bearings and front springs.

(3) Comfort and ease of operation in winter were generally neglected in the Lend-Lease vehicles. For example, canvas tops provided absolutely insufficient protection. Pedals were placed too close together so that drivers in felt boots could operate their vehicles only with difficulty. Radiator shutters were lacking, and had to be improvised from local materials.

(4) Outstanding characteristics of British trucks are the following: short wheelbase and easy turning; equal weight distribution on the front and rear axles; large, single, ground-gripper tires (10.5/16 or 10.5/20) which have lower resistance than dual treads in mud or snow, and less of a rocking effect on bad roads. The seat over theengine provides better visibility but poorer access for servicing. The very low gear ratio of 1 to 7.94 is an important advantage.

(5) In U. S. vehicles the following characteristics are outstanding: 5th speed ratio less than 1.0 for high-speed, partially loaded travel; syncro-mesh transmission for 3d, 4th and 5th speeds; transfer case; hypoid-gear final drives; hydraulic brakes and Diesel engines.

(6) Evaluation of the "jeep' class (Willys MB, Ford, Bantam RC) shows the following characteristics of military value: low deadweight, high power and reliable four-wheel drive. But the bodies are too small and uncomfortable for winter operation in the USSR; also, it is essential that the cab be covered. In other regards, the Willys MB and Ford are suitable prototypes for Soviet manufacture.

(7) In the light-truck class (Ford 2G8T, Dodge WF-32, Bedford OXD, and Austin K-30), the British vehicles have insufficient power and too much deadweight, although their shorter wheel base and smaller cargo area make them more suitable for dirt roads than U. S. vehicles. For heavy going, a 4x4 truck (1½ tons) with a winch, comparable in design to the Dodge WC-51, ¾ ton vehicles, is the best replacement for the GAZ M-415 Pickup as a military vehicle.

(8) In the medium-truck class, the Studebaker US 6-62 is the best prototype. For military purposes, the 6x6, 6x4 and 4x2 are all desirable, but in all cases maximum torque and transmission characteristics are essential. For commercial as well as military needs in the USSR, pulling power and cross-country travel ability are more important than speed.

Recommendations for Future Soviet Truck Design:

(1) In basic design principles, high initial cost must be balanced against upkeep and repair (in which Soviet vehicles are very poor). Design must be adapted to peculiar Soviet conditions. All civilian models must be adaptable to military requirements. Radical changes in design are needed, and attempts simply to modernize the GAZ-AA and ZIS-5 will lead to technological bankruptcy. Modernization of Soviet fuel, oil, lubricants and brake fluids is mandatory for the development of modern types of motor-vehicles.

(2) Engines should be in-line six-cylinder, and L-head (for easier maintenance and readier adaptation to producer-gas and compressed gas).

(3) All details requiring periodic servicing must be readily accessible from the top of the engine. This is especially important for operation in cold weather.

(4) The fan and water pump must be relocated and redesigned. The fan should be geared independently with a variable-speed gear to permit reduction of its speed of rotation in cold weather. Relocation of the water pump is necessary to permit design of a single, conveniently located water outlet for the radiator.

(5) The oil intake must be located below the surface of the oil, in order to avoid clogging with ice from surface water-vapor condensation in very cold weather

(6) The fuel pump and filter should be as high as possible for better accessibility; the filter should be on top of the pump to effect a better vacuum.

(7) The fuel pump filter must be so situated that its disassembly will not spill gasoline on the electrical system or the mechanic's hands, which can cause serious damage or injury in winter.

(8) The cylinder block should have removable liners of high-quality cast-iron.

(9) Removable exhaust-valve inserts and removable thin steel-backed main bearings are important elements in easing repair and lengthening engine life.

(10) Mounting the crankshaft on roller bearings may prove desirable, since it would greatly reduce friction, fuel expenditure and wear, particularly under winter conditions.

(11) Special hardening of all surfaces exposed to severe friction is essential.

(12) Maximum attention must be paid to filtration of air, fuel and oil. The air filter must be an oil-bath type, as large as good servicing characteristics will permit. Two oil filters are essential: one, a mechanical filter (Cuno type), with openings not larger than 0.05 mm (0.00197 in.); the other an absorption type with a removable element for the full regeneration of the oil. In addition to the fuel filter on the engine, a separate fuel filter is needed near the fuel tank (e.g., on the frame beams). It should be designed to remove the water vapors which often cause ice-locks in the fuel line between the tank and carburetor. The fuel pump and carburetor filter must be easy to remove, disassemble and clean.

(13) There must be a minimum number of oil pipes exterior to the engine block. A floating oil intake is dangerous, since it is often clogged by ice. Easy removal of the oil pan is vital.

(14) Forced ventilation of the crankcase is mandatory to prevent formation of water vapors subject to freezing.

(15) A radiator shutter, manually controlled from the driver's seat, is absolutely indispensable. The water (or anti-freeze) cooling system preferably should be sealed. A thermostatically controlled circulation system of the Mack type is necessary, since with it the coolant circulates into the engine block only after it has been warmed. Forced circulation with flow directed to dissipation of "hot spots" in the upper part of the block, but not in the lower, is needed. The lower part of the coolant circulation system should be provided with a single, large, easily manipulated outlet valve near the forward end of the radiator to permit rapid drainage of the coolant. This is especially important if water or an insufficiently concentrated anti-freeze solution has to be used during very cold weather.

(16) A downdraft carburetor patterned on Solex Model IFF should be adopted, since it provides maximum heating for the intake manifold. The configuration of the intake manifold must permit mechanical removal of tar and carbon.

(17) Maximum economy with partial loads should be achieved through vacuum spark correction, automatic choke, and reduction of friction in the crankshaft system.

(18) For effective starting in winter, more powerful electrical system (12 and 24-volt) thermal insulation of batteries and a pre-heating system for the coolant, crankcase oil and intake manifold are necessary. For pre-heating, an auxiliary liquid or air circulation system heated by a kerosene lamp (as already developed in the Soviet light tank) should be designed. For extreme cold, a direct fuel-injection system is essential; preferably, it should be a manual pump type operated from the driver's seat, with a capacity of about one liter (0.9 qt) of gasoline plus 10 to 15 per cent oil.

(19) The following elements of chassis design should be adopted: 5th speeds with a ratio of less than 1.0; transfer cases (auxiliary transmissions) not only for military but also for civilian trucks; hypoid-gear final drives; worm-and-roller steering gear; hydraulic brakes (with booster for heavier vehicles); paraboloid leaf springs (Willys type) and shock absorbers. Winches should be introduced on Soviet trucks.

(20) At least the driver's compartment must be covered under Soviet climatic conditions; open or canvas-covered compartments are too hard on personnel.

(21) No compromises can be tolerated with achievement in the USSR of the following POL standards:

Gasoline	Winter	Summer
Boiling begins	30-50 C	50-55 C
10% evaporation	50-60 C	78-80 C
50% evaporation	110-116C	148 C
90% evaporation	177 C	196 C
End of evaporation	210 C	225 C

Octane rating: not less than 70. Oil: Winter-viscosity 4° E at 50 C. Summer-viscosity 8-10° E to 50 C. Viscosity index not less than 100.

Greases: Hypoid gear grease with activated sulful; other activated greases for moderately high pressures. Solid greases for wheels and water-pumps; graphite for leaf springs; Marfak-type lubricants for universal

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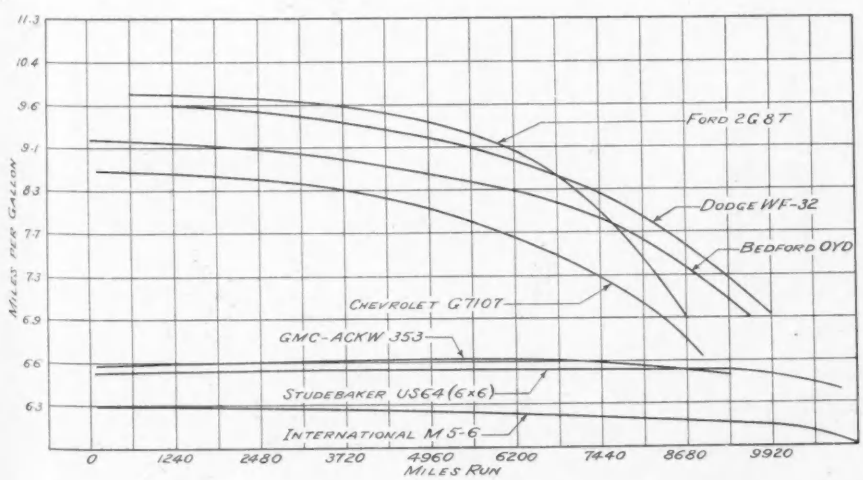
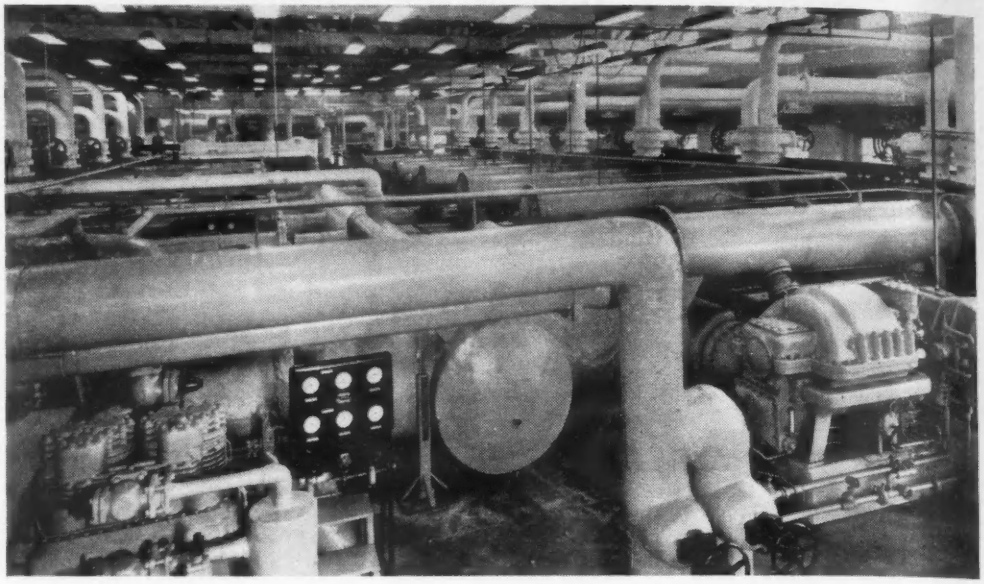


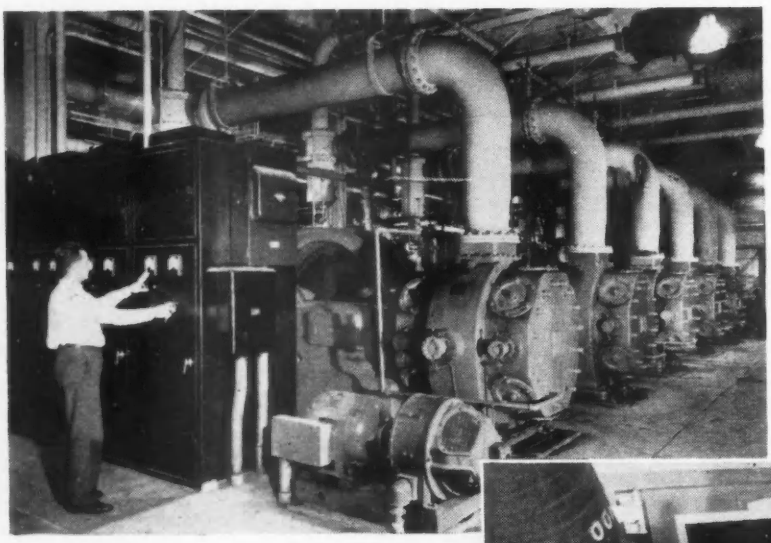
Fig. 1—Increase of fuel consumption with vehicle mileage from Soviet tests.



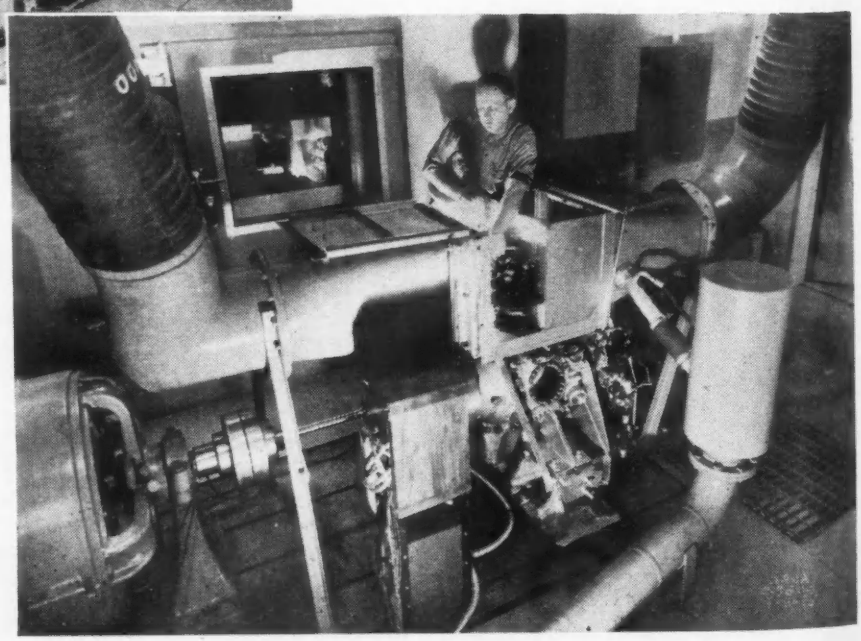
A part of the refrigerating machinery installed to produce the low temperatures at which aircraft propulsion devices are tested in the altitude wind tunnel. This plant can lower the tunnel temperature to — 48 F.

Manufactured Weather

THE Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics manufactures its own weather for testing aircraft engines. As shown by the accompanying photos, huge air compressors, exhausters, and refrigerating machinery are used to duplicate flight conditions of the desired humidity, pressure and temperature in various testing laboratories, in an altitude wind tunnel and a supersonic wind tunnel.

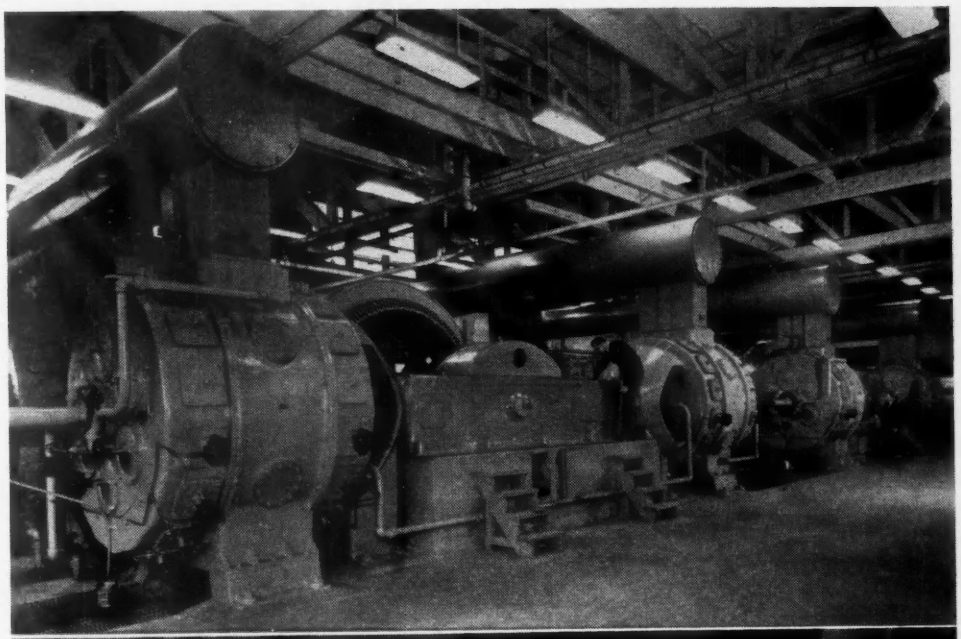


(Above) Six large air compressors with a total capacity of 15,000 cfm supply combustion air at 30 psi or less to laboratories in the engine research building so that supercharger conditions may be effected for high altitude tests.

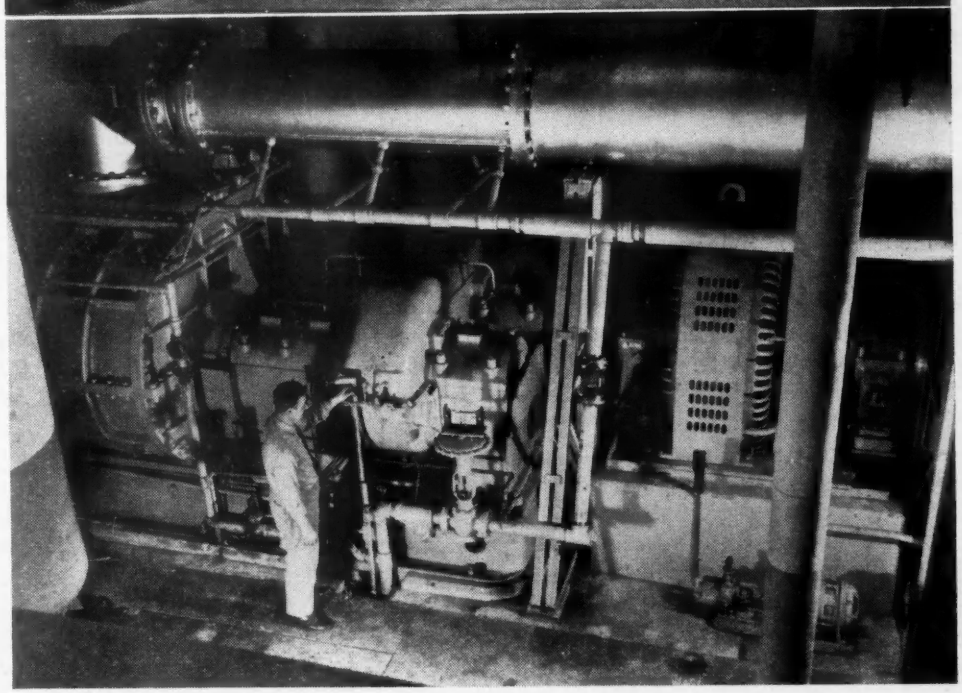


(Right) A typical laboratory hookup shows how the air from the various groups of compressors is used. This is a test of a single-cylinder air-cooled test engine, mounted in a cooling air duct with plastic windows. The inlet air surge tank is directly behind the operator and the exhaust connection and surge tank are in the right foreground.

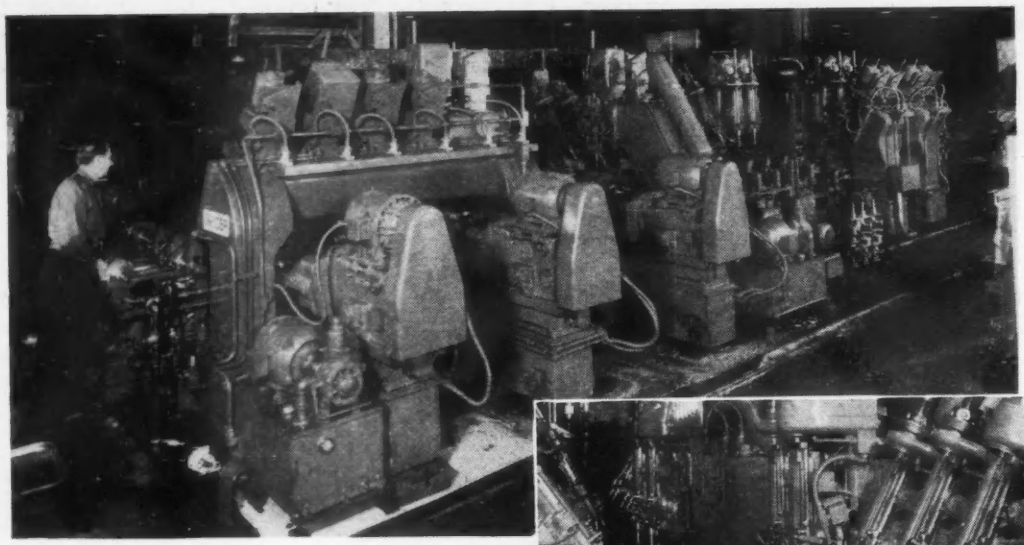
Aerial view of the NACA's Aircraft Engine Research Laboratory in Cleveland. The altitude wind tunnel, which is capable of testing complete aircraft propulsion installations under altitude conditions up to 30,000 ft and pressure conditions up to 50,000 ft, may be seen in the center. The engine research building is the large building between the wind tunnel and the roadway to the right.



General view of a part of the installation of exhauster pumps used to produce the required low pressures in the altitude wind tunnel for testing aircraft propulsion devices under simulated altitude conditions.

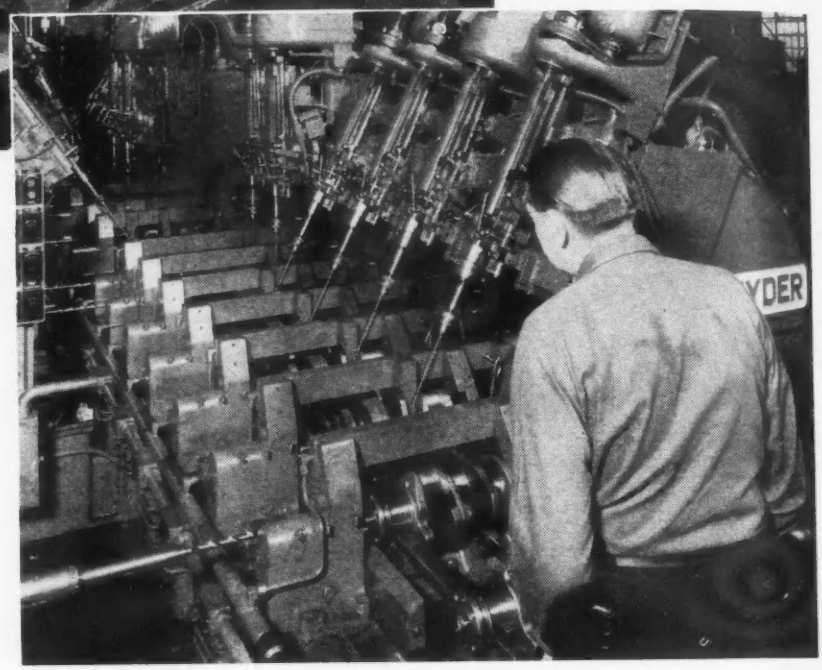


This is one of the six exhausters which supply low-pressure air for laboratory testing of engines at low atmospheric pressure conditions.



(Left) Perspective view of Snyder progressive transfer-type drilling machine for drilling oil holes in V-8 engine crankshafts.

(Below) Perspective showing end station of the Snyder crankshaft oil hole drilling machine. This station is fitted with W. F. & John Barnes hydraulic units.



CONTINUING its long range policy of developing automaticity of machining operations, Ford Motor Co. has introduced what is perhaps the first example of a progressive transfer type line for drilling crankshaft oil holes. The machine illustrated here, one of a group designed by Snyder Engineering in cooperation with Ford specialists, features a combination of Avey hydraulic Torquematic sensitive drilling heads and W. F. & John Barnes hydraulic drilling units.

Perhaps the best way to appreciate

First Transfer Machine for Drilling Crankshaft Oil Holes

the extent of the forward step taken here is to compare the new set-up with conventional practice in which crankshafts are drilled individually in batteries of machines and shifted from one group to another in sequence. The new method requires only the loading of crankshafts onto the transfer conveyor by an operator at one end, the rest being entirely automatic. Work is locked in place automatically at each station. Between each of four major stations there is an idle station and at each of these the work is rotated by means of slides in the conveyor so as to present the proper bearing to the fixture.

It may be noted that this arrangement was developed not only to provide automaticity but also to meet the requirement of a change in lubrication requiring more passages than heretofore. In the present crankshaft of the 100-hp V-8 each of the connecting rods is fitted with an individual precision bearing—instead of the single wide bearing used up to now. This requires two oil holes in each pin as well as the addition of a large-diameter oil reservoir hole with a communicating angular hole.

The specification of 16 oil holes in the current crankshaft would have required an even more extensive conventional layout of machinery with extra handling and a still further increase in direct labor on this job.

For the most part the drilling of oil holes—except at the last station—is done with torque control, the mechanism being arranged for step-by-step drilling. The large—0.408 in. diameter—holes for the oil reservoir are each drilled in a sequence of four separate operations—rough drill, ream, and two finish drilling steps to assure straightness and smoothness.

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An Engineering Omission That Cost $16,000,000 and 52 Lives

By Robert McLarren

A SIMPLE engineering phenomenon, which no designer could have foreseen in the flat stretch of a blueprint and which no layman can possibly comprehend, has wreaked havoc with the vast business of air travel and pointed up an object lesson for all engineers, regardless of their special field. Because aviation is a dramatic business its minor mistakes are all too often dramatic boners in newspapers and greivous tragedies in many homes. But the brief story of the Douglas DC-6 holds several hard won lessons for the airlines, the aircraft manufacturing industry and the wider technical fields of transportation and the numerous technological industries.

The Douglas DC-6 was born during the war as a logical development of the famed DC-4. Briefly, the new model was an improvement over the old by the addition of more powerful engines, a pressure cabin, a strengthening of the structure for the increased gross weight and innumerable minor improvements including several pioneering advances. The prototype was designed and built as an Air Force cargo/passenger type, designed the XC-112. This version made its first test flight Feb. 15, 1946, with veteran test pilot Ben O. Howard at the controls over Santa Monica, Calif., home of the Douglas plant.

The 300 mph cruising speed, 52-passenger accommodations, 2500 mile range and the innumerable safety features rendered the DC-6 an ideal commercial airliner of advanced type and production orders were placed by United Air Lines, American Airlines, Braniff Airways, National Airlines, Pan American Grace, Sabena (Belgium), KLM (Dutch) and a number of others. One of the first DC-6 transports was the XC-118, a special version designed for the President and named the "Independence." Assuredly, few airliners have had a more auspicious start.

Deliveries began early in 1947 and by the early fall of last year more than 90 of the craft had been delivered. Many had completed thousands of miles of safe, comfortable travel when on Oct. 24, 1947, a DC-6 of United Air Lines caught fire and crashed against the rim of Bryce Canyon, Utah, taking the 52 lives of all those aboard. The tragedy was blazoned across every newspaper headline in the nation and air travel was brought up sharp in its rise, leveled and descended precipitously within a periof of a few days. Some 40 representatives of Douglas Aircraft, United Air Lines and the Civil Aeronautics Board hurried to the scene.

The thankless task of investigating a tragedy began at Panguitch, Utah, but the disintegration of the airplane (parts were found along the flight path 26 miles from the point of impact) rendered the cause determination difficult, although a clear sequence of structural failure of the airplane was gained from the wreckage along the flight path. First step was an order for the removal of all flares from DC-6 aircraft, a precaution indicated by the fire aboard the Bryce Canyon airplane. Next step was an order for all operators to remove the fiberglass insulation of the airplane at the next inspection period including a complete inspection of the hydraulic, oil, fuel, electrical, heating and ventilating systems to be accomplished no later than Dec. 1, 1947. In both of these orders, all the airlines complied. Meanwhile, Douglas Aircraft Co. continued day-and-night efforts to correct an unknown fault in the airplane and hours of flight tests, ground tests, shop tests and engineering studies continued daily.

On Nov. 11, 1947, an American Airlines DC-6 caught fire en route from San Francisco, Calif., to Tulsa, Okla. The captain turned the plane towards the airport at Gallup, New Mexico, and made a successful landing. Within three minutes all of the 21 passengers and crew of four cleared the plane safely and within 30 min the fire had been extinguished. But the pattern was clear and Douglas Aircraft Co. requested all DC-6 operators to ground their airplanes until further notice, a request immediately complied with and 93 DC-6 transports ceased operation, a considerable load potential for the airlines. The "Independence" was grounded by the Air Forces.

What had caused these midair fires? The answer in great detail is now available: the cabin heater of the DC-6 is of the combustion type and is located amidship under the cabin floor. An airscoop in the belly admits ram air into this heater. Forward of this under-wing air scoop, about 10 ft forward and slightly to the right is the air vent line for the No. 3 alternate wing tank. It was standard airline practice after takeoff and climb had been accomplished on the main tanks for the pilot to switch each engine to its alternate tank. When a minimum of about 85 gals was left in each alternate tank, the fuel was transferred from the higher of the alternate tanks to the lower to equalize the contents of all alternate tanks. The process of pumping fuel from No. 4 alternate tank to No. 3 alternate tank caused the latter tank to overflow unless

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Recent Developments

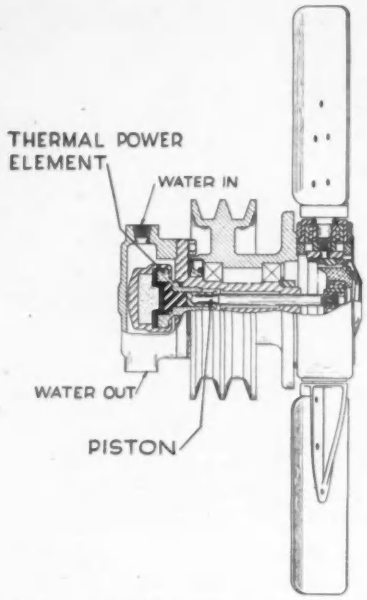

Fig. 1—Sectional drawing of a thermostatically-controlled variable pitch fan.

By Fred M. Young
President, Young Radiator Co.

AN AUTOMOBILE or truck fan will reach the maximum required rotational speed at approximately 40 mph vehicle speed. Beyond this point the fan speed increases directly with engine and vehicle speed, and the fan horsepower increases as the cube of the speed. The result is excessive fan horsepower consumption. Also, excessive fan horsepower is consumed in cold weather, for instance when the ambient air temperature is below 50 F. Jacket water temperature control through the bypass action of the engine thermostat is needed for warm-up, but thereafter the ideal arrangement would be control through fan regulation.

One fan designed to conserve power is thermostatically controlled and has variable pitch. This is shown in full pitch in Fig. 1. The thermostatic element is exposed to the engine-jacket water flow and actuates the piston which in turn feathers the fan blades through a system of cams and eccentrics. Throughout the range of temperature and road speed, the pitch of such a fan will be varied from virtually zero to full pitch. While the fan speed remains the same as with a conventional fan, the horsepower will be reduced approximately as the 1.5 root of the projected blade depth ratio.

Another type of power-saving fan utilizes an electro-magnetic unit in an application of the eddy-current coupling. Electric power is taken from the generating system of the automobile and put through a thermostatic voltage regulator installed in the outlet water hose. This is essentially a carbon pack rheostat against which a

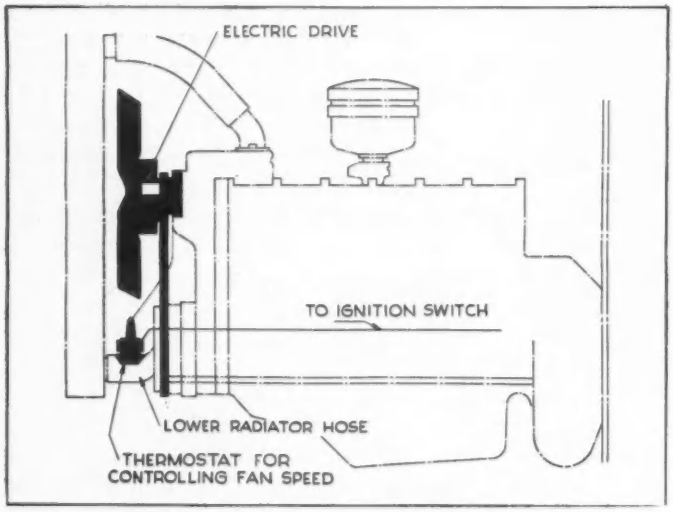

Fig. 2—This diagrammatic sketch shows a typical engine installation of the electric fan drive.

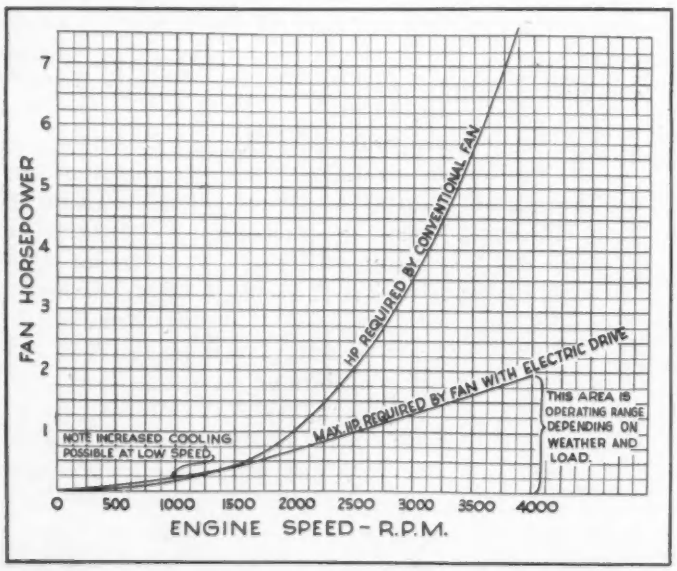

Fig. 3—These curves of fan horsepower vs. engine speed show the lower horsepower requirements and increased cooling capacity at low speeds of the electric-drive fan in comparison with the conventional fan.

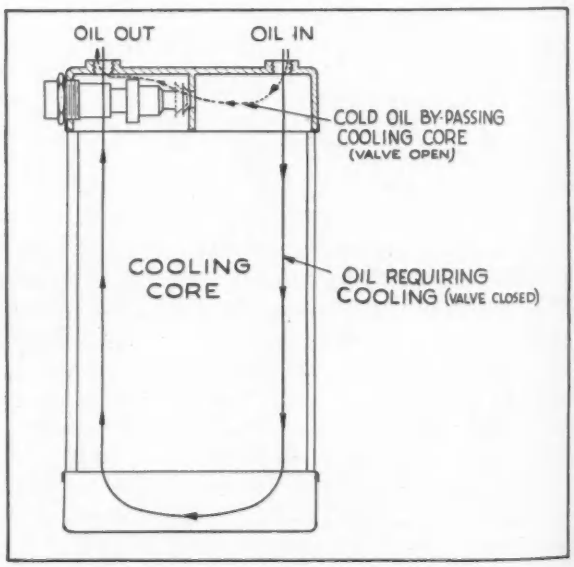

Fig. 4—Sectional drawing of oil cooler, showing location of wax-filled thermostat.

in Engine Cooling

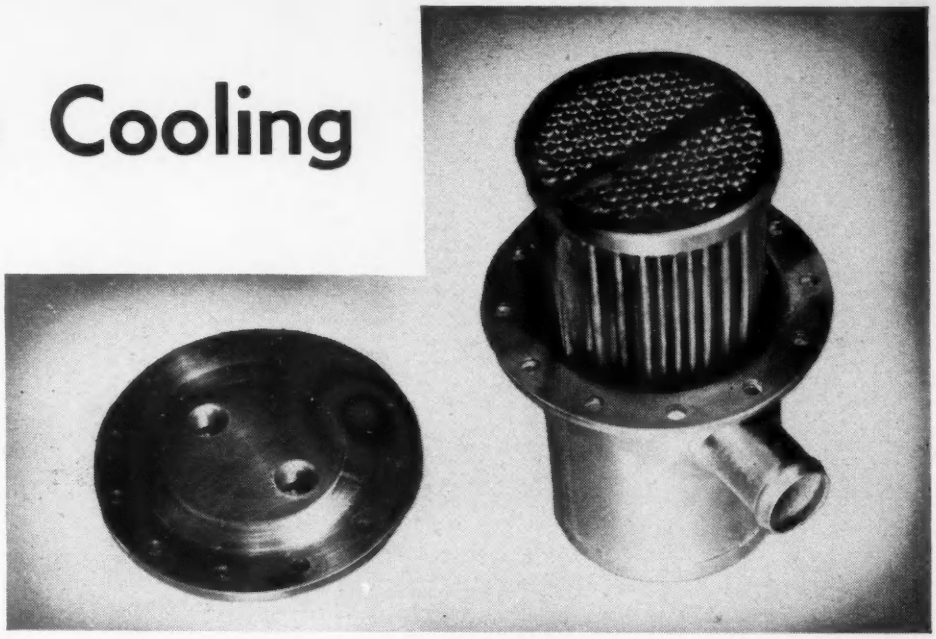

Fig. 6—Water-cooled oil cooler, disassembled.

thermostatic bellows exerts varied force with changing water temperatures. The degree to which the carbon granules are packed varies the voltage to the rotating windings which in turn varies the slip in rotational speed. A typical installation of this electric fan drive is shown diagrammatically in Fig. 2.

The electric fan-drive can be wound so that a maximum torque and speed is attained which corresponds to the critical road speed. The result is a saving of fan horsepower of approximately 75 per cent at the higher speeds. This also permits the use of a greater projected depth in the fan blades, which in turn increases cooling at low speeds. This is shown graphically in Fig. 3. Substantial horsepower savings will also be obtained with lower ambient air temperatures. Fan horsepower will be reduced as the cube root of the speed over conventional fans.

Air swept crankcases provide some oil cooling on passenger cars and on most trucks and buses. Oil temperatures in summer weather will reach the range of 250 to 300 F at the dip-stick. It is obvious that the temperatures are therefore much greater in other parts of the lubricating system. Granted that an average road vehicle is "getting by," oil cooling with temperature control has the following advantages:

1. Oil volatiles are retained, thereby minimizing gumming, varnishing and ring sticking.
2. Oxidation and some forms of sludging are minimized.
3. Maximum lubrication through pre-selected oil viscosity and temperature is obtained.
4. A portion of the waste engine heat can be taken off in Diesel engines through oil cooled pistons.

Oil cooling for road vehicles can be accomplished directly by means of an air-cooled oil cooler which can be mounted integrally with the engine cooling radiator, and furnished with or without thermostatic control.

A recent control development for oil coolers is a wax-filled thermostat. The manner in which this is applied to an air-cooled oil cooler is shown in Fig. 4. The outlet oil temperatures can be controlled within a range of about 8 F. Various control temperatures may be obtained through varying the thermostatic mix. Common temperature settings are 160 to 180 F.

Fig. 5 shows the wax-filled thermostatic valve in quarter section. This is basically the same as used in the variable pitch fan of Fig. 1. Ground copper particles are mixed with the wax filling to increase the sensitivity to temperature changes. The larger spring is a relief spring which relieves back pressures caused by cold oil "slugs" during warm-up periods when the valve may have been extended for temperature regulation. Expansion of the wax is transmitted through a neoprene diaphragm, a neoprene plunger and to a brass piston which is bottomed so that the valve poppet is moved in the opposite di-

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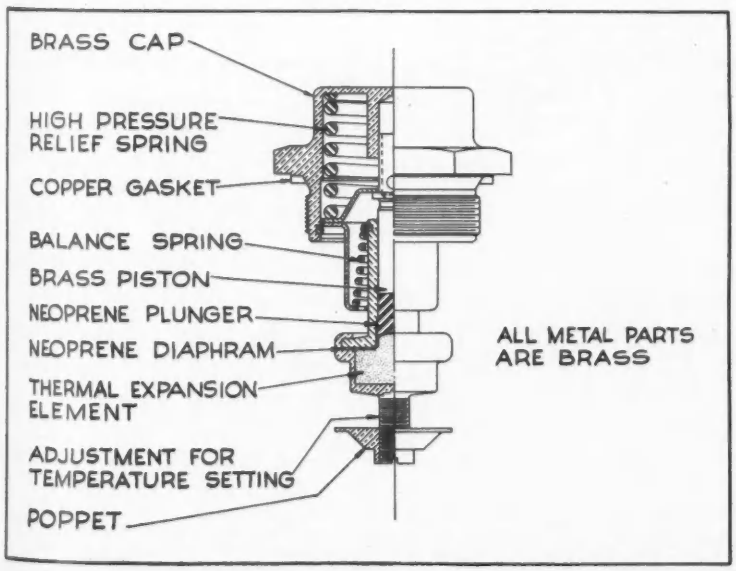
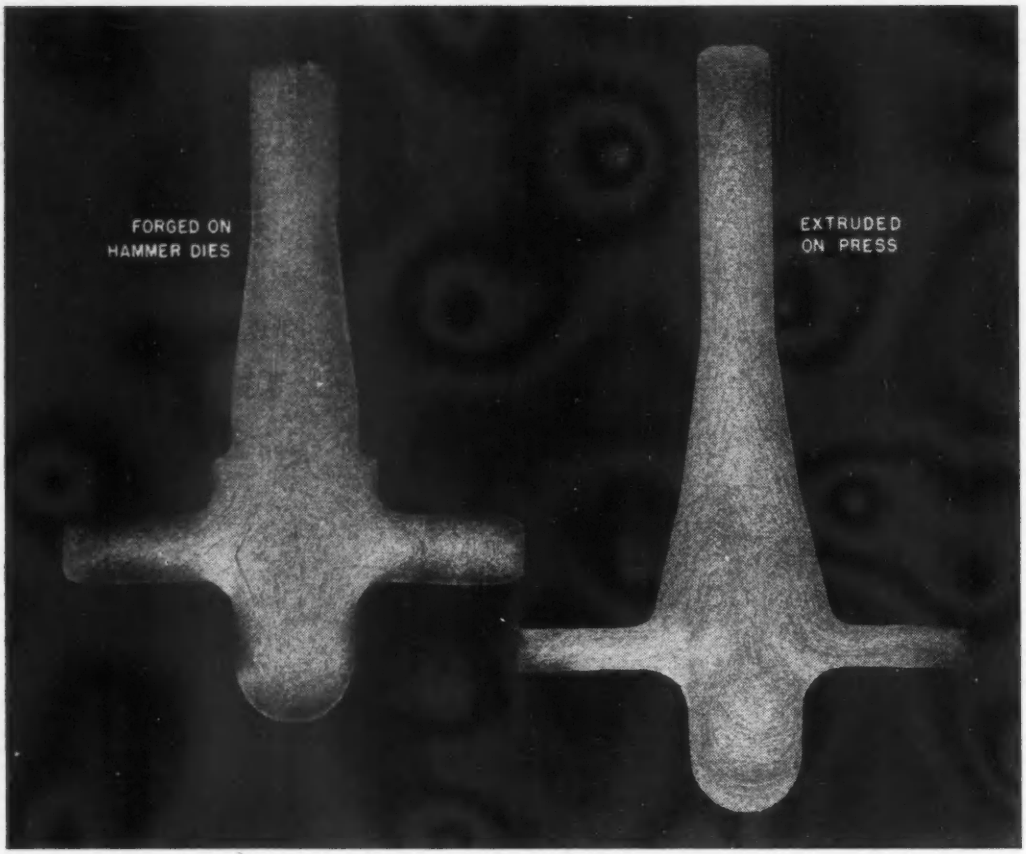


Fig. 5—Longitudinal quarter-section of the wax-filled thermostatic relief valve for an air-cooled oil cooler.



Comparison of grain flow pattern of the Ford passenger car front spindle as made by two techniques. The view at the left shows the older method of hammer forging while the cross-section at the right is of a spindle made by hot extrusion.

Extrusion Forging Ready For Mass Production

Initial Application at Ford Canton Foundry Will Be in Making Spindles with Other Parts to Follow. Pilot Operation Discloses Engineering and Manufacturing Economies

ALTHOUGH extrusion forging in a heavy duty forging press is unique so far as mass production application goes, the principle involved was developed in experimental production at the Ford Motor Co. almost ten years ago. Now it is of interest that extrusion forging will constitute a major activity in the new Canton Forge shortly to be placed in operation by Ford. The first application of the process is in the making of Ford passenger car front spindles at Canton. Later on they intend to extrude intake and exhaust valves. And once the operation is established the research organization will be studying the economic possibilities of making other parts by the same process. All in all the current program visualizes a vertiable revolution in forging practice. The simple fact is that for parts such as the front spindle n character—a combination of a relatively massive section and a long slender shaft end—the process offers not only production economy but an improvement in physical properties as well.

Through the courtesy of the company the actual production

(*Turn to page* 60, *please*)

PRESENT UPSET AND HAMMER FORGING

1—Shear (weight for 2 spindles—15 lb)
5—Ford Slot Type Billet Heat Furnaces
5—4 in. Ajax Upsetters
1—Grinder (Snag when necessary)
4—Ford Slot Type Billet Heat Furnaces
4—2500-lb Erie Steam Hammers
4—55½ Toledo Trim Presses
4—56 Toledo Restrike Presses

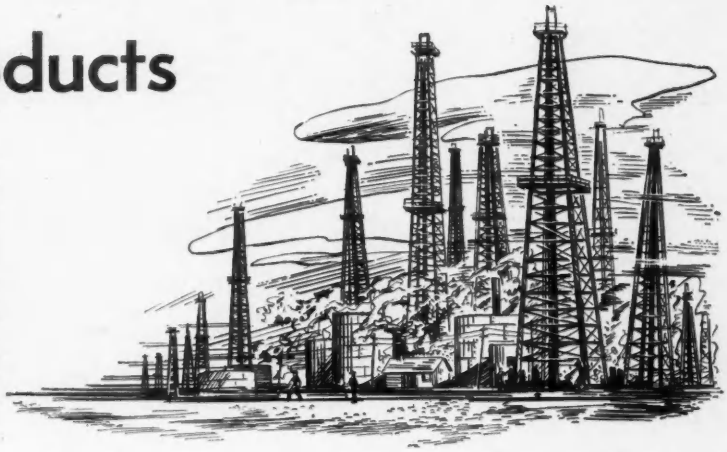
Spindles per forging—2
Weight of forging—15 lb
Weight of machined spindle—3.70 lb
Personnel Requirements (2 shifts)—46 men
Floor Space Requirements—5000 sq ft

PROPOSED EXTRUSION FORGINGS

1—Shear—5¼ lb
2—700 KVA Induction heating unit with two heaters
2—No. 5 National Maxi-Press
2—Trim Presses
3—Double Wheel Grinders

Spindle per billet—1
Weight of billet—5¼ lb
Weight of machined spindle—3.85 lb
Personnel required (2 shifts)—16 men
Floor space requirements—1000 sq ft

The Ever-Increasing Demand for Petroleum Products



What is causing the current huge demand and tight supply of petroleum products? Are we going to exhaust our reserves within a few years, or is current exploration and development keeping pace with depletions? What about synthesing liquid fuels from natural gas and coal? Can oil be separated from shale and tar sands on an economical basis? These are some of the questions discussed in this article based on a paper presented in Detroit in January by Bruce K. Brown and R. C. Gunness of the Standard Oil Co. (Indiana) before a joint meeting of the Engineering Society of Detroit, American Society of Chemical Engineers, and American Society of Mechanical Engineers.

TWENTY-FIVE years ago world-wide production of crude oil was about 1,900,000 bbl per day; by 1945 it had risen to more than 7,000,000 bbl per day. Current U. S. production of crude oil is at a rate twice as great as in 1935 and four times as great as in 1921. Twenty-five years ago about 27 per cent of each barrel of crude oil was made into gasoline. Last year over 40 per cent was so converted, and with modern equipment the industry could produce a 75 per cent yield if gasoline were the only product desired. It may thus be seen that, over the past quarter century, the petroleum industry has increased its output of all products over four-fold. Nevertheless, although progress has been enormous, it has barely enabled the oil industry to keep pace with an apparently ever-increasing demand.

The United States demand for finished petroleum products in 1947 constituted an increase in consumption of 12½ per cent over the preceding year, and of 25 per cent over 1941. The total 1947 needs of petroleum products for domestic use, export, and governmental use was 8.3 per cent higher than the peak annual demand during World War II. Demand for gasoline was up seven per cent over 1946, and 20 per cent over 1941, while that for gas oil and distillate fuel oil—that is, products of the type used for home heating and Diesel engines—was up 16 per cent over 1946 and 63 per cent over 1941, as shown by Table I.

With regard to the future, there is nothing to indicate that demand for liquid petroleum fuels will not continue to increase year by year. Even a serious economic dislocation would probably do no more than retard the trend; it would not turn the demand curve downward. Gasoline consumption per car is expected to remain high in spite of great improvement in the quality and potential efficiency of gasoline, because it is believed that the customers will elect largely to take advantage of fuel improvements in the form of larger cars, faster acceleration, higher top speeds, and more comfortable driving, rather than in the form of greater mileage per gallon. Truck and other commercial vehicle registrations have been predicted to increase in number at an even faster relative rate than passenger car registrations, and should rise to more than seven million by 1970. Gasoline consumption is expected to rise from the 1945 figure of approximately 33 barrels per year per vehicle to about 43 barrels by 1970. On the basis of the above, a summary prediction of all gasoline usage in 1970 is 3,160,000 barrels a day, as shown in Table II.

In 1940, there were approximately two million oil burners in operation. It was estimated last year that the number of domestic oil burners would rise to four million by 1950 and to five and one-half million by 1970. At this level approximately 22 per cent of the one- and two-family homes in the colder areas will be heated by oil. On this basis, domestic fuel oil consumption would be approximately 250 million barrels by 1970. Oil burner installations have been proceeding even more rapidly than was predicted nearly a year ago.

It is felt that Diesel fuels will also be used much more widely by railroads and other users during the next quarter century. In spite of the greater original cost of Diesel locomotives, railroads are buying them in increasing numbers because of their manifest advantages as compared with steam locomotives. The present rapid increase in the number of Diesel locomotives is occurring particularly in the large sizes—freight and passenger locomotives, which use from 4000 to 8000 barrels a year of Diesel fuel, as compared with the 1000 barrels used by the small switching Diesels now in such common use. Also, a substantial increase is expected in the proportion of marine Diesel power, and other Diesel uses will also increase —farm tractors, electric power plants, smelters, and miscellaneous uses.

Table III shows that an increase in demand for petroleum products of 31 per cent over the next 23

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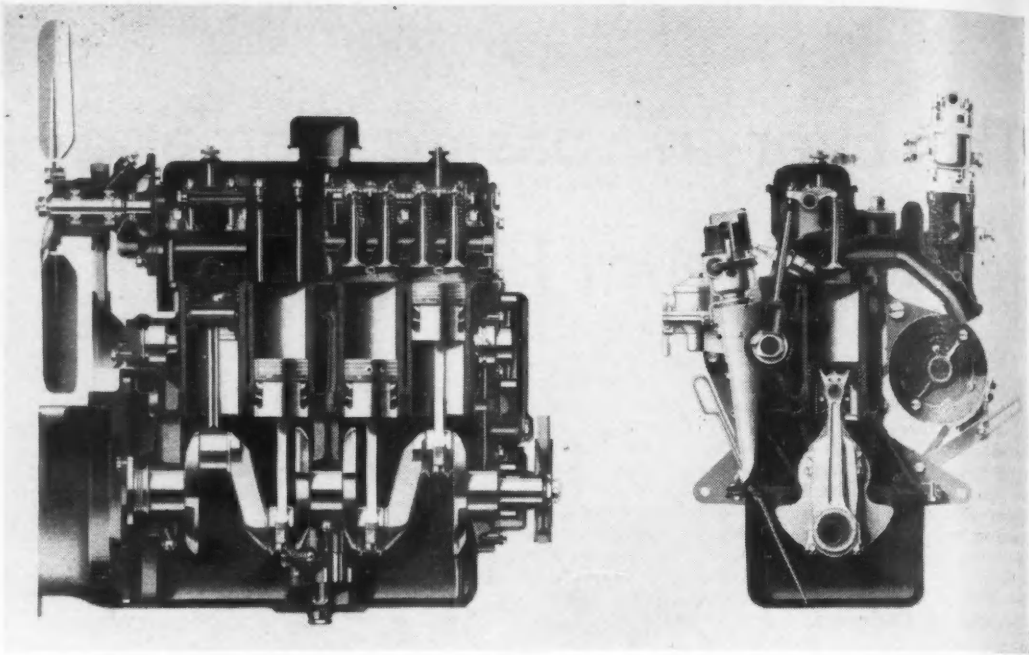
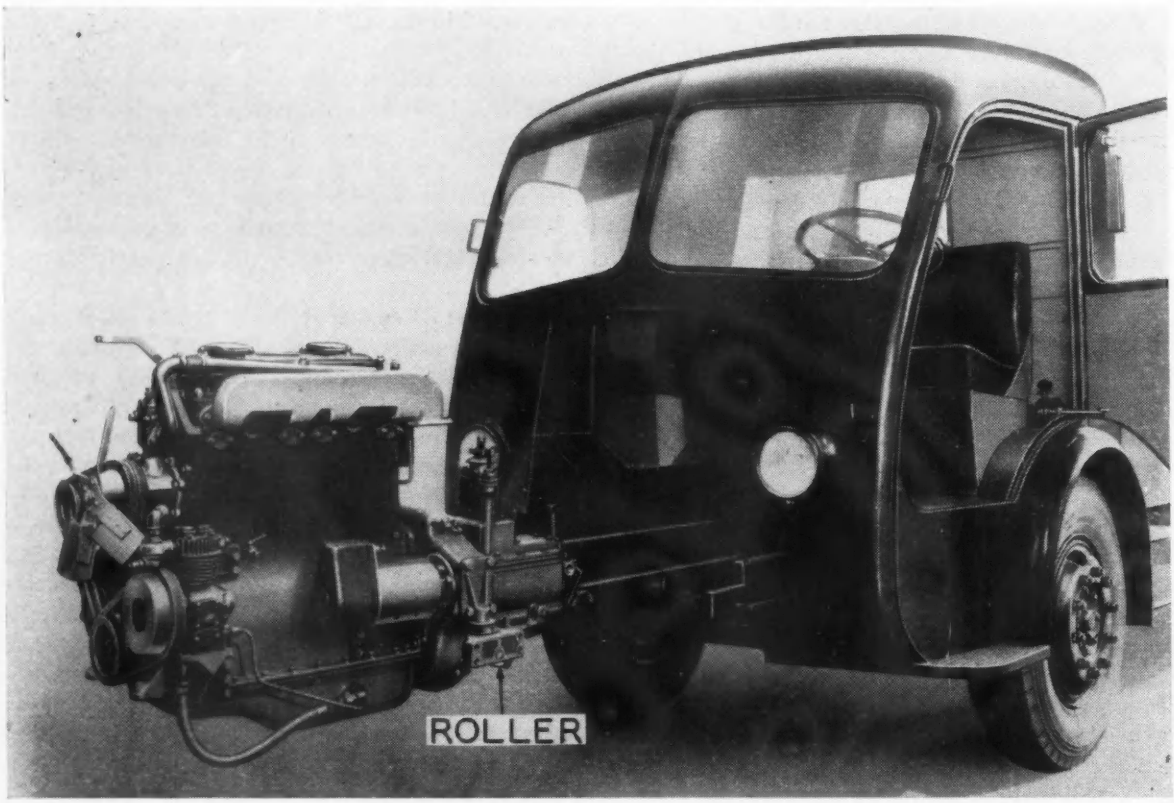
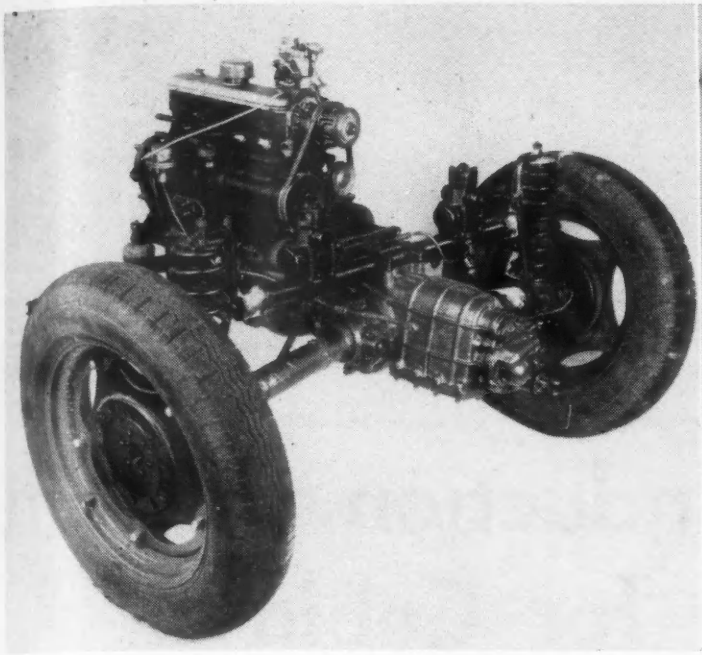


Cutaway drawings of the French Renault 19-hp four-cylinder engine.

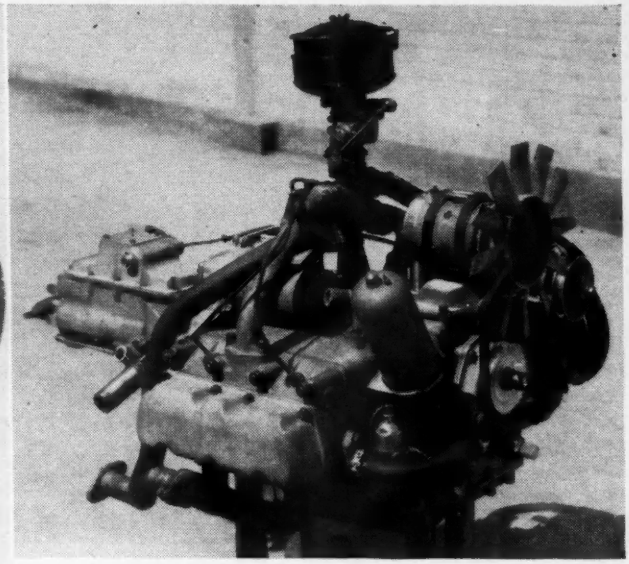
Latest European Designs



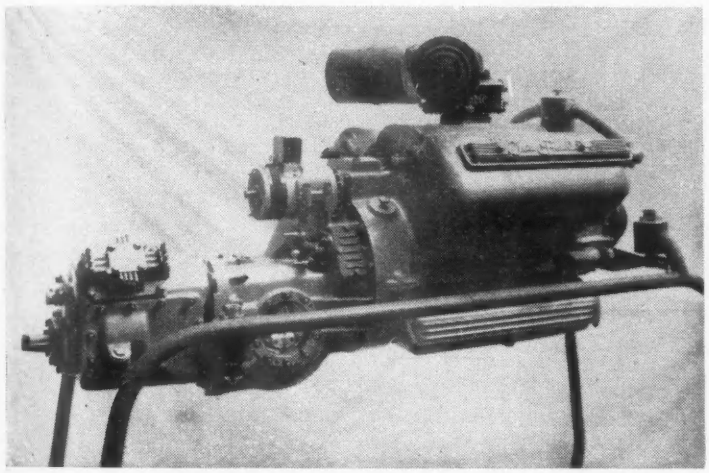
The engine of the five-ton Panhard Diesel truck can be removed easily by means of the rollers and side members, as illustrated here.



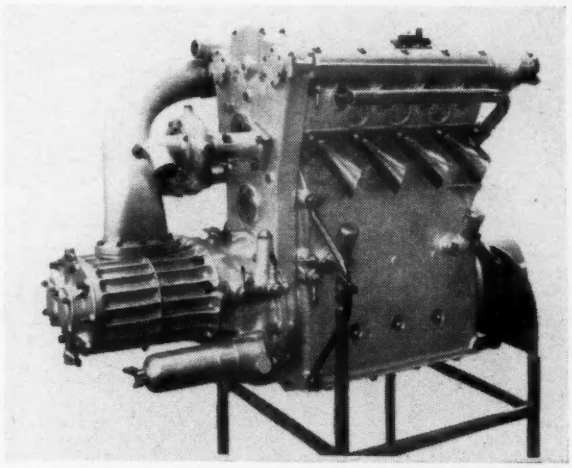
Rear axle and engine installation of the French Renault. The four-cylinder engine is carried ahead of the rear axle, while the transmission is located behind the axle.



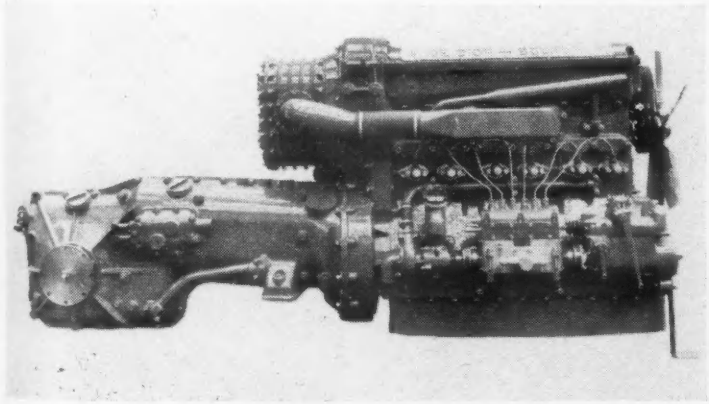
The front-wheel drive French Gregoire. Its four-cylinder, 64 hp engine is shown in this photo.



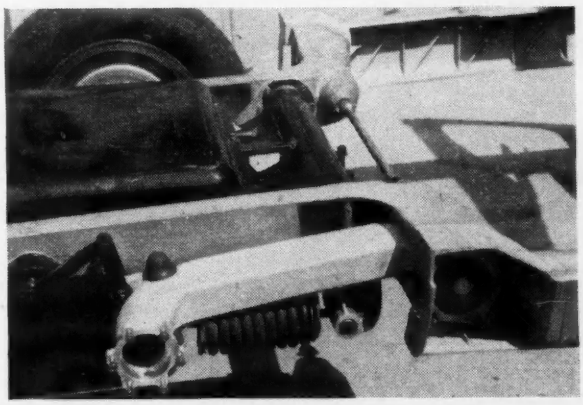
Rear-mounted rear-wheel drive V-eight Isotta Fraschini engine described in the Dec. 1, 1947, issue, page 29, of AUTOMOTIVE INDUSTRIES. This newly-developed engine has a displacement of 207 cu. in. and develops 125 hp at 4200 rpm..



This four-cylinder supercharged racing engine of 91.5 cu in. displacement was built by Ettore Bugatti and features an aluminum alloy head and dual camshafts.



De Dion two-stroke supercharged six-cylinder Diesel engine for coaches is rear mounted, and features dual crankshafts. The cylinder bore is 2.56 in.; combined strokes of the two double pistons are 5.51 in.; and output is 100 hp at 300 rpm.



The rear suspension of the Gregoire, pictured here, consists of horizontal coil springs which can be adjusted for length and flexibility.

Boeing B-50 Induction System Pressurizes Air for Cabin

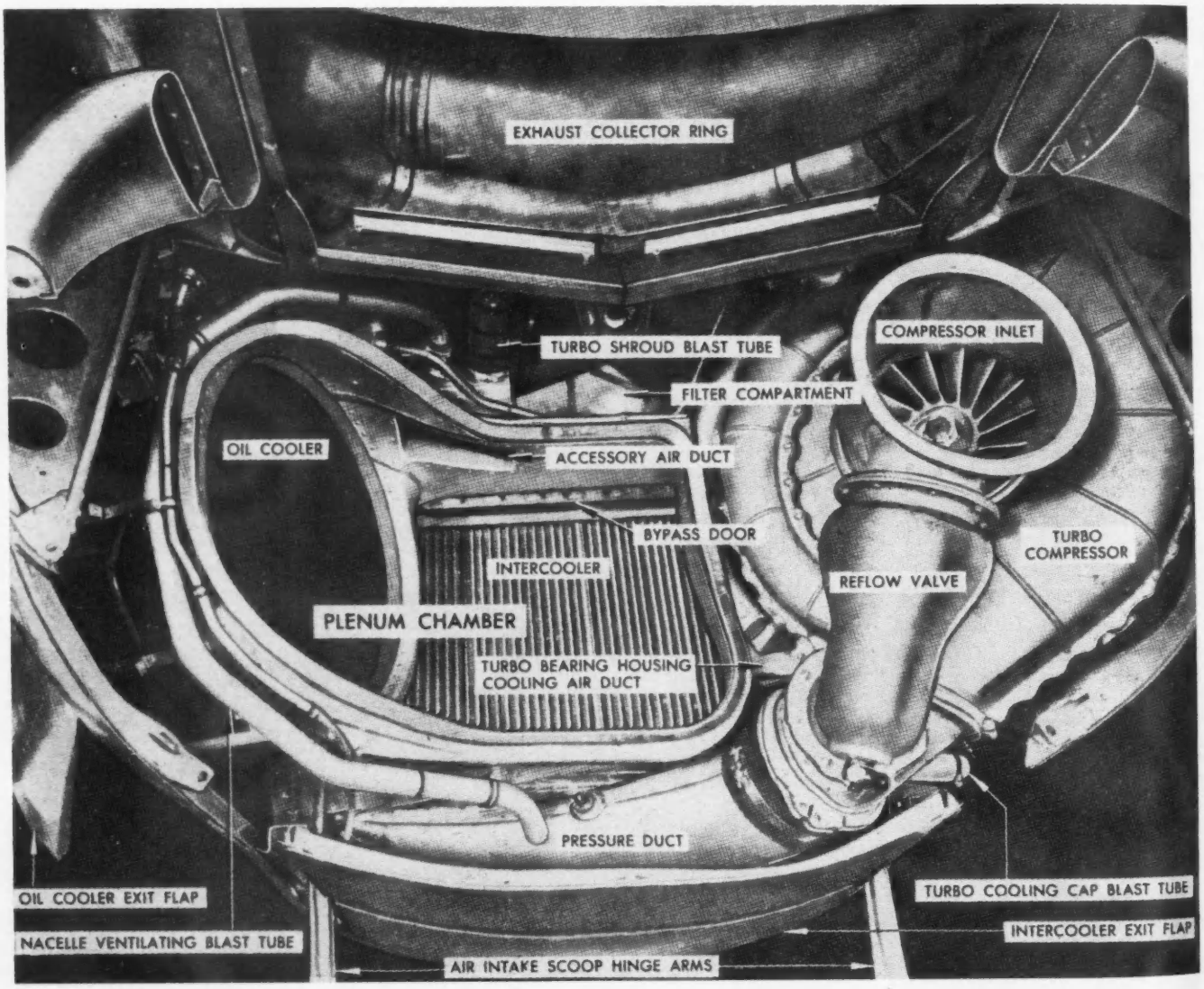


Fig. 1—Most of the components of a B-50A engine air induction system are visible in this view taken from directly ahead and a little below the intake scoop with the hinged section of the scoop lowered.

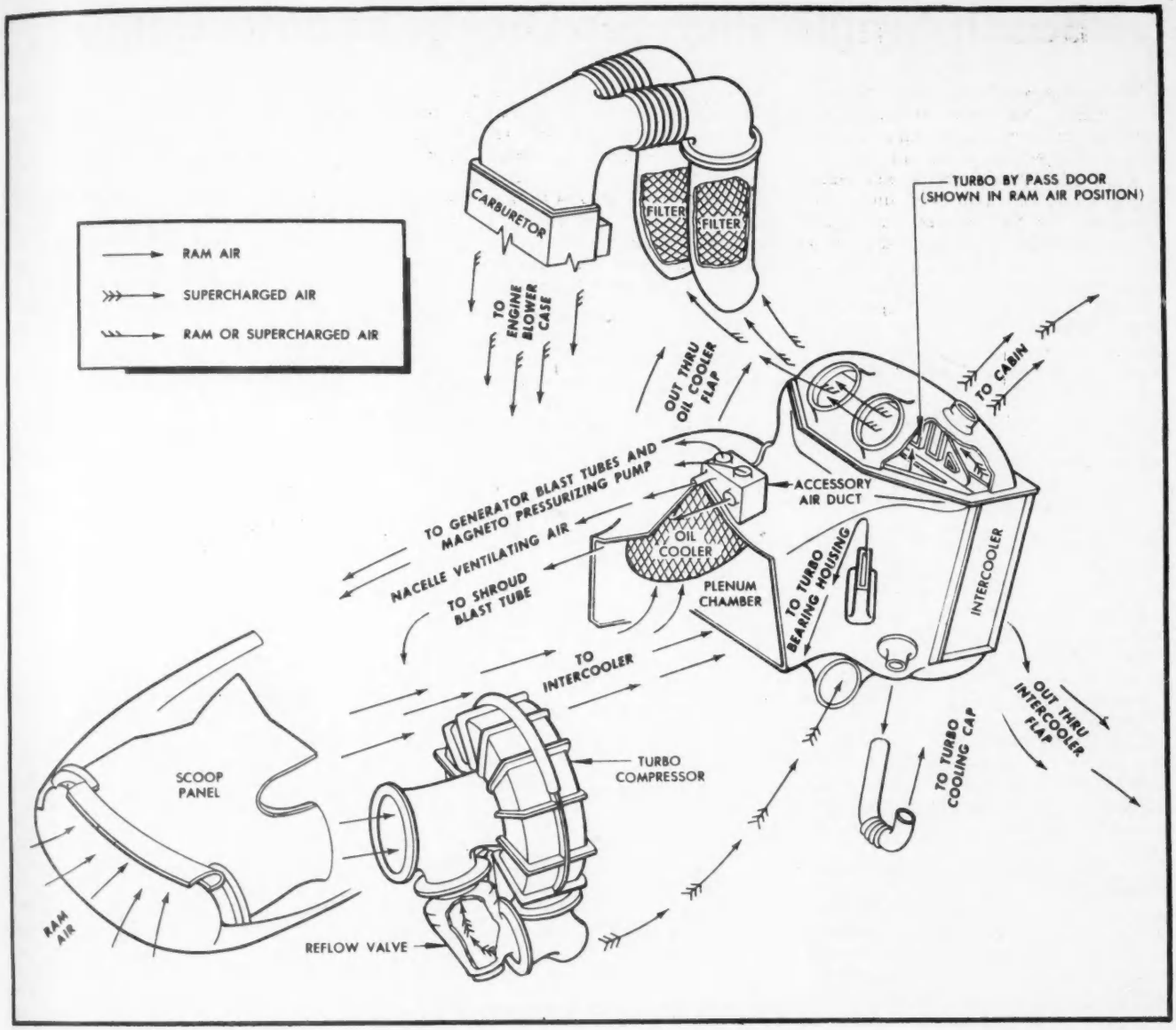


Fig. 2—Airflow pattern through a B-50A inboard power package induction system. The connection to the cabin air system is capped in the outboard nacelles.

ALTHOUGH the primary purpose of the induction systems on the Boeing B-50A is to supply the four engines with air for combustion, they also have supplemental functions, which are to furnish cooling and ventilating air to various accessories, and, in the case of the inboard nacelles, to provide pressurized air for the cabin. Main components of the system, shown in Fig. 1 and 2, consist of the plenum chamber, turbosupercharger, intercooler, turbo bypass door, carburetor air filters, oil cooler, and accessory air duct. A cabin pressurization connection is provided on the inboard systems.

Plenum Chamber

Ram air for the system enters a single intake scoop on the underside of each nacelle. The ram air from the scoop enters the plenum chamber from where it is distributed to the engine and accessories. In flight, the pressure increase in the chamber, which results from ram and the action of the propeller, more than offsets the pressure loss through the ducts. The inlet pressure at the carburetor is therefore higher than atmospheric even when the turbo is not in operation. The plenum chamber pressure is also used to force the air through the accessories and coolers.

Turbosupercharger

The single turbo in each induction system, General Electric type CH-7A, is located on the lower left side of each power package and provides low altitude pressure to the engine and the cabin when the airplane is operating at high altitudes. The exhaust gases are gathered and delivered to the turbo by the exhaust collector and are either discharged through the nozzlebox diaphragm to drive the bucket wheel or bypassed through the wastepipe, depending on the position of the wastegate. The wastepipe and nozzlebox discharge into a common exhaust hood from which the gases pass into the atmosphere. To improve engine fuel con-

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Bosch Single-Plunger Diesel Engine Pump

The American Bosch Corp., Springfield, Mass., has now formally announced its new single-plunger type PSA fuel injection pump for automotive Diesel engines which, according to the Company, has been under development for the past several years. It is being produced initially in a size identified as the PSA. .A (Fig. I) which is designed for normally-aspirated four-stroke-cycle engines of piston displacement up to approximately 80 cu in. per cylinder or for fuel quantities up to about 90 cu mm per stroke.

The new type PSA pump is built with the same precision as earlier Bosch types; its lower cost is inherent in its design, which is very simple, requiring many fewer parts. A single plunger and a single delivery valve do the work formerly allocated to four or six plungers and delivery valves, depending upon the number of cylinders to be served. The pump complete with governor and supply pump has less than half the size and weight of present multi-plunger Bosch pumps of equal capacity.

The American Bosch Type PSA fuel injection pump is driven at crankshaft speed on four-stroke-cycle engines. It is a pump of the cam-actuated, constant stroke, throttled-intake type, the single plunger having a continuous rotary motion in addition to its reciprocating motion, thus serving as its own fuel distributor. Although a multi-outlet unit, it has only a single delivery valve. The PSA is equipped with a fuel supply pump of the positive-displacement gear type located at the side of the pump housing, and a variable-speed governor of the mechanical-centrifugal type incorporated at the rear, driven directly off the end of the camshaft without gearing. Present production includes both the four-cylinder type (PSA-4A) and the six-cylinder type (PSA-6A). Another series, the PSA-4B and PSA-6B of larger capacity, also has been developed for ultimate production.

Details of construction and operation can be described with special reference to the accompanying illustration of the four-cylinder assembly, PSA-4A (Fig. 2). The pump has a flange mounting for attachment to the engine. The drive gear furnished by the engine manufacturer is carried on the drive hub (8).

The camshaft has an integral spur pinion which meshes with the face gear (6) to rotate it at one-half pump shaft speed. Tappet (2) is situated within the mating splined bore of the face gear and rotates with it at half engine speed while being at the same time cam-reciprocated. A lower spring seat (4), having three driving lugs on its bottom face engaging corresponding holes in the tappet, rests upon the inside bottom surface of the tappet and is held against it by the two plunger return springs (10), or by one of these if the pump is not on a high-speed engine. The lower spring seat is rotated by the tappet and in turn rotates the plunger through the plunger guide (3). The plunger (11) is actuated on its upward or pumping stroke by the cam lobes and tappet. Plunger return on its downward reciprocating stroke is effected by the plunger springs.

The face gear with tappet, spring seats, springs, plunger guide and plunger rotate as one unit in phased relationship with the camshaft. The camshaft in the four-cylinder pump, type PSA-4A, has two lobes 180 deg apart. Thus, with two revolutions of the camshaft necessary to produce one complete revolution of the face gear and plunger, there are four equally spaced pumping strokes during each plunger revolution. In the case of the six-cylinder pump, PSA-6A, the camshaft is provided with three lobes spaced at 120 deg apart in the same plane. The PSA-4A and PSA-6A are otherwise identical except for the number of outlet connections and necessary drilled ducts in the barrel head.

The upper or pumping end of the plunger is of plain cylindrical form. The metering principle of the pump is that of throttled intake. The amount of fuel admitted to the barrel between plunger strokes is controlled by the positioning of throttle valve (21) in the fuel inlet duct. The fuel admitted is trapped when the

(*Turn to page* 64, *please*)

Key to Reference Numbers

(1) sleeve bearing, (2) tappet, (3) plunger guide, (4) lower spring seat, (5) pump camshaft, (6) face gear, (7) ball bearing, (8) drive hub, (9) gear housing, (10) plunger return springs, (11) plunger, (12) upper spring seat, (13) lower horizontal duct, (14) delivery valve spring, (15) delivery valve, (16) barrel, (17) displacer piston stop, (18) lock nut, (19) vertical groove in plunger, (20) displacer piston, (21) throttle valve, (22) flexible diaphragm, (23) throttle valve spring, (24) leaf spring adjusting screw, (25) inspection plug, (26) idle adjustment leaf spring, (27) operating shaft, (28) torsion spring, (29) governor lever assembly, (30) governor housing, (31) governor weights, (33) lubricating oil connection.

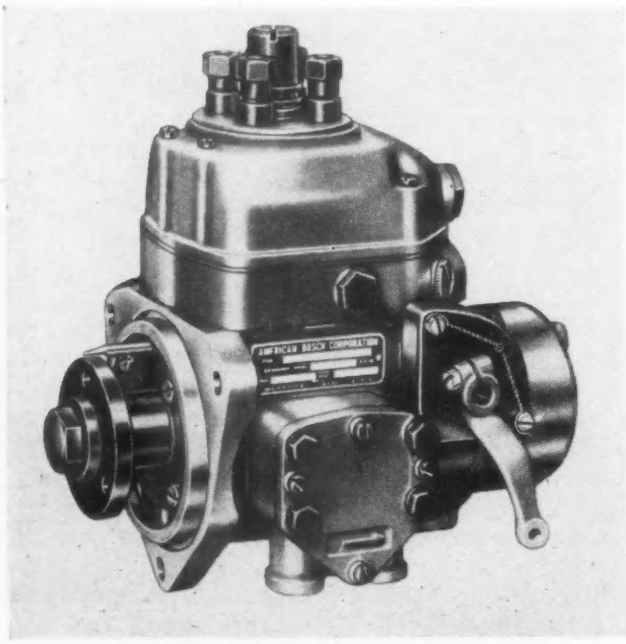


Fig. 1—Type PSA-4A injection pump assembly

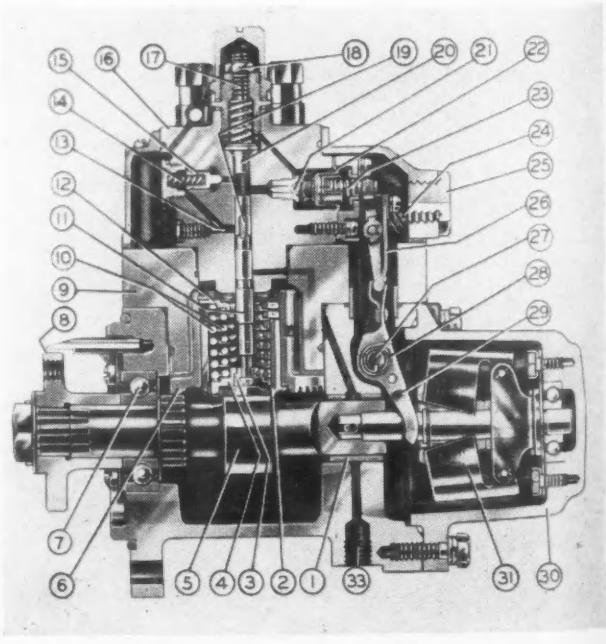


Fig. 2—Cut-away view of PSA fuel injection pump

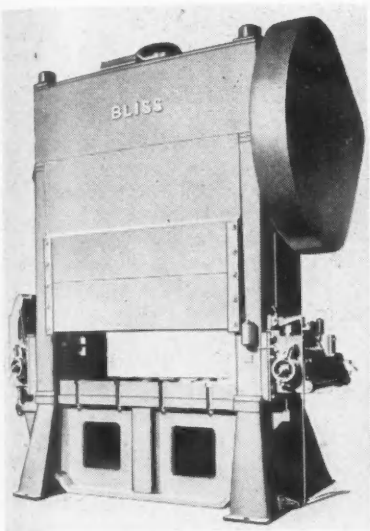
NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 62.

J-58 — High Production Press

E. W. Bliss Co. of Detroit, Mich., announces the largest press in its No. 600 series of high production presses. The new unit, which was recently installed in the plant of a large automotive manufacturer, is a 300-ton press used to form floor panel reinforcements in eight steps of a progressive die. The No. 6290-D is completely automatic with double roll feed and scrap shear synchronized so as to feed and trim predetermined lengths. Specifications and dimensions for the new 6290-D press are as follows:

Frame construction is of stress-relieved, steel weldments with bed, uprights and crown held together by



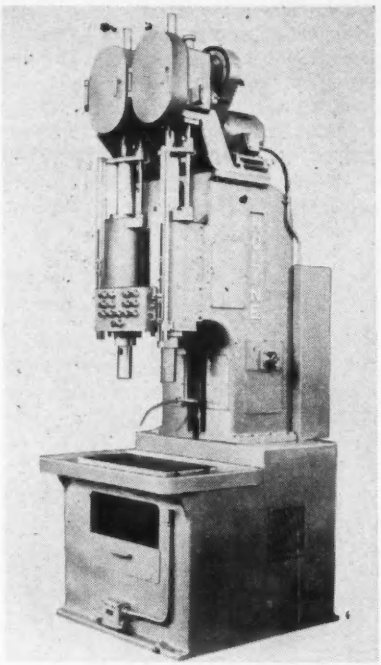
Bliss No. 6290-D high production press

four pre-shrunk steel tie rods. The press has single gearing with single end drive. Herringbone gears run in oil. Air friction clutch is furnished with controls by electric push button. Gibbing is square with bronze lining. Press bed is arranged to receive die cushions. Lubrication is by automatic force feed. Strokes per minute—30 to 45. Distance between uprights, to clear—84 in. Stroke of slide—6 in. Slide area—32 in. by 77 in. Die space from bed—23½ in., from top of bolster—17 in. Bed Area —42 in. by 84 in.

J-59—Drilling Machine

A recent development by Moline Tool Co., Moline, Ill., is the HF148 drilling machine. The illustration shows the machine made up as a two-column model with individually-controlled hydraulic feed to each of the two spindles. It can be built as a single-column, single-spindle machine or as a multiple-column, multiple-spindle machine as well.

The spindle is designed with capacity to drive a 1⅛-in. drill in mild



Moline HF148 drilling machine

steel. The HF148 makes available to metal working plants a machine which is capable of handling a variety of miscellaneous drilling and reaming jobs, but which can be used as a production machine when fitted with appropriate fixtures to hold the work.

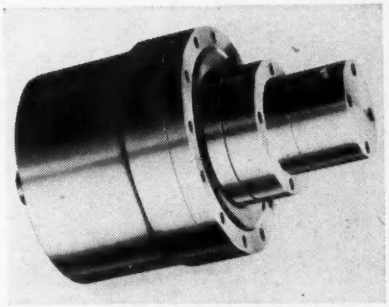
Electrical control of the hydraulic feed permits an independent, automatic-operating cycle for each spindle which can be initiated by push-button or foot-operated switch. Selector switches in the push-button station can be set so that either spindle will repeat the feed cycle continuously until stopped by the operator. In the two-column model, both spindles can be run in alternate, continuously repeating cycles by means of electrical interlocking. Thus while one spindle is drilling, the other is in the "up" position so that the operator can be reloading the fixture.

J-60 — High Speed Air Cylinders

The Cushman Chuck Co. of Hartford, Conn., offers an entirely new series of high speed air cylinders as an addition to the line of Cushman air-operated power chucking equipment.

Cylinder bodies are aluminum alloy forgings of high tensile strength and are finished with lapped bores. After assembly, the cylinders are statically balanced to eliminate vibration at high operating speeds. Air ports are larger than previous specifications, resulting in rapid movement of the piston and speeding up the chucking of work pieces on short run operations.

A feature is the design and construction of the air seal. This seal is a piston fitted with a Graphitar disc which forms a positive seal with two annual rings that are integral with the end of the piston rod. A



Cushman air cylinder

balanced air pressure is maintained back of the piston thus providing balanced air pressure on both sides of the air seal. A light load on the seal is maintained through spring pressure.

J-61 — Transmission Dynamometer

A new 25-hp transmission and absorption dynamometer, with a speed range of 200 to 6500 rpm has been added to the line of the Electro Mechanical Devices Co. of Detroit. This new EMDCO Model E is designed for testing gasoline engines, electric motors, air compressors, fluid motors, fuel pumps, and gear pumps.

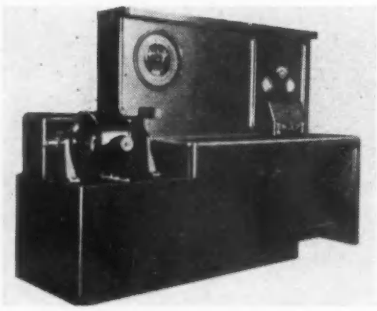
The EMDCO Model E is a completely self-contained unit, with the motor generator set mounted and wired in the base. The user need only connect his three-phase wires and fasten the unit to the floor to make it ready for operation. One control is used for all tests; no switching is necessary to go from motoring to absorption. The change is made automatically when the rheostat control increases or decreases in relation to the speed of the unit being tested. Torque is read clockwise on scale, regardless of direction of rotation by dynamometer,

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 62.

and is also read directly in ft lb, making conversion unnecessary.

The manufacturer states that the Model E is an exceptionally compact unit, using minimum floor space. Dimensions are as follows: Length—9 ft; height—72 in; Depth—3 in. Controls have precautions against over-



EMDCO dynamometer

load, overspeed, and field failure. After speed has been increased beyond minimum, no reversal or restart can be made until the speed is brought back to the minimum.

J-62—Abrasive Cut-Off Machine

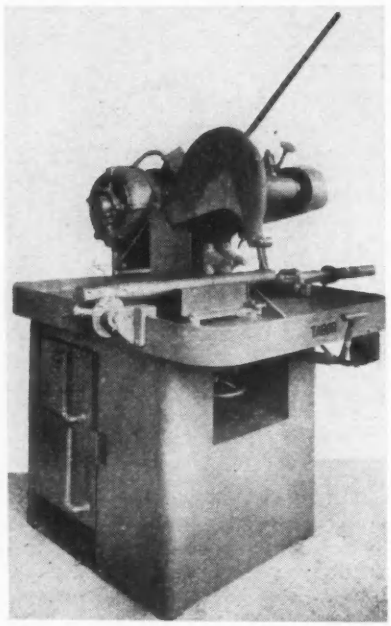
A new cut-off machine, the Type D10FWP, designed primarily for the metal-working industry and particularly applicable where brass, bronze and steel in bar stock, tubing, angles and flats require cutting, has been placed on the market by the Tabor Manufacturing Co., Philadelphia, Pa. The new equipment will also cut plastics.

Cost per individual cut is reduced by providing adequate power to maintain the proper wheel speed in cutting any quantity of metal or plastic. This is supplied by a fully-enclosed, fan-cooled 10-hp motor.

The quick-acting clamp is provided with a hand-wheel which quickly adjusts start of tension on any stock. Downward thrust of a lever applies the tension. Two clamps, one on each side of the wheel, hold the work so securely in V-blocks that end support of uncut stock is unnecessary.

When any cut is about to begin, the adjustable stop swings to an upright position, preventing the cut piece from binding the wheel. When wheel is retracted following cut, the stop falls back into position for measuring the next cut.

Coolant is fed to both sides of cutting wheel at the hub. It is then

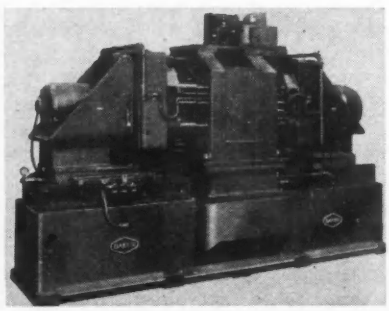


Tabor Type D10FWP cut-off machine

thrown centrifugally at the cut, causing over-all cooling action, providing faster cutting and an improved surface finish to the cut edge, according to Tabor.

J-63 — Two - Way Horizontal Machine

Baker Brothers, Inc., Toledo, Ohio, have recently developed a two-way horizontal machine for high production machining of automobile engine connecting rods and caps. The new machine, of special floor-type construction, is furnished with a six-station, trunion-type power index fixture arranged to clamp one connecting rod and cap at each station; and utilizes two Baker Model 15 by 16 hydraulic feed saddle units. The saddles of these units are equipped



Baker two-way machine

with hardened steel replaceable flat ways that allow a 16-in. travel of saddle. Positive depth stop and delayed reverse attachment can be included when desirable.

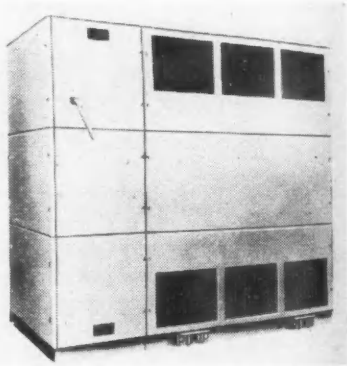
In the illustrated installation, the right unit is equipped with a 20-spindle fixed center multiple head, assembled with a self-contained lubricant pump, and driven by a 10-hp motor. The left unit drives a 12-spindle head, powered by a 7½ hp motor.

The 15 by 16 unit has a high rate of rapid traverse and saddle feed, and may be mounted in horizontal, vertical or angular planes.

Hydraulic power is provided for each of the 15 by 16 saddle units by a completely separate variable delivery portable pump-sump unit mounted on casters.

J-64 — Load Center Transformers

Dry type Class B insulated load center transformers for plant power distribution circuits are now being built by Wagner Electric Corp., St. Louis 14, Mo., in the following ratings: Three-phase, 60-cycle, 100 to 2000 kva, with high voltages of 2400, 4160, 4800, 7200, 12,000, 13,200, or



Dry type load center transformer made by Wagner Electric Corp.

14,400, and low voltages of 600, 480, 240, or 208/120. All are rated 80 C rise, with natural ventilation.

Transformers are housed in paneled enclosures designed for indoor installation. Matching compartments for primary and secondary switchgear can be furnished as required, to form complete, closely-coupled unit substations. Removable panels facilitate cleaning and inspection, and complete enclosure of all equipment safeguards against accidental contact with live parts.

Efficient cooling of the core and coils is accomplished by exposing as much radiating surface as possible to the air. Vertical ducts through the core and vertical and horizontal ducts through the winding provide maxi-

mum ventilation and reduce internal temperatures.

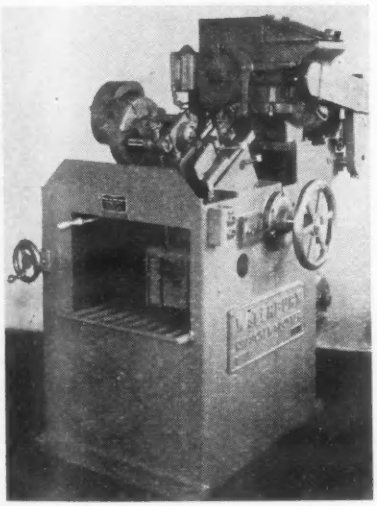
Insulation materials are mainly class B; class C materials are used where extra strength is needed. Coil conductors have double servings of fiber glass. Successive baked coats of heat-resistant synthetic varnish give the windings a tough high gloss finish.

Transformers can be furnished with equipment for indicating winding temperature. Fans for increasing the capacity 25 per cent may also be provided when the possibility of load growth warrants this addition.

J-65 — Newly-Designed Screw Slotters

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., is manufacturing two newly-designed screw slotters, Nos. 0 and 1. These two machines are now built with welded steel frames, improved hopper feed, new twin-cutter burr remover, and infinitely variable production speeds. The No. 0 machine has a production rate of from 40 to 125 screws per minute; the No. 1 is rated at from 20 to 80 screws per minute.

The hopper, from which the screws



Waterbury Farrel No. 0 screw slotter

enter the feed chute, is equipped with a rotor having pockets which pick up the screws and deposit them into an inclined chute. A clearing device in the hopper prevents the blanks from clogging as they enter the chute, permitting them to slide down successively to a carrier dial at the lower end of the chute. This dial is notched to receive the blanks one at a time and is indexed counterclockwise to carry them to a position directly under the saw. While in this upright position, the screws are firmly clamped during the slotting operation, after which the burrs are automatically clipped off by the burr remover. The clamping device then releases, permitting the notched dial to carry the screw blank around until it drops into the delivery trough.

The saw arbor is chain-driven through change gears, and it is installed in a frame which may be swung up to a vertical position for convenience in changing saws. Change gears may be furnished to provide 17 different speeds, three of which are included with each machine as standard equipment. The depth of slot and the total feed stroke are regulated by means of two hand knobs.

J-66 — Adjustable Drillhead

Thriftmaster Products Corp., Lancaster, Pa., has rounded out its line of adjustable, multiple spindle drillheads with a new universal joint drive model. The drillhead, which is full ball bearing mounted, features flexibility of operation and strong construction. It is made for use with power feed, and is rated at full capacity of ¼ in. drills in steel.

Gears and spindles are of alloy steel. The drillhead is furnished with two—six spindles, minimum 1⅛ in. center spacing within 6¼ in. diameter circle. It is made for right-hand rotation of the drill press.

J-67—Optical Comparators

The new Jones & Lamson bench type optical comparators and measuring machines are available in two basic models with different table assembly combinations at Jones & Lamson Machine Co., Springfield, Vt.

These two models offer a wide choice in the selection of a machine best suited to individual needs.

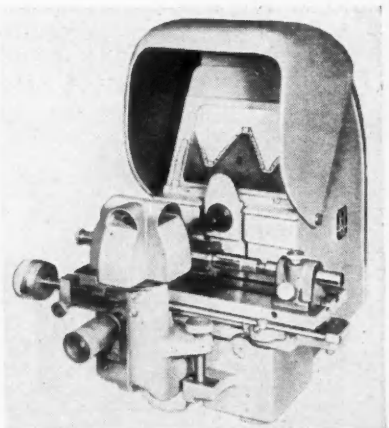
The BC-7 Model offers a choice of three table assembly combinations. The BC-7 A equipped with a 12-in. plain table is used for comparing the magnified shadow of an object with a master outline. It handles objects up to 3 in. in diameter. The BC-7 B has a 14-in. table that can be compounded for inspecting objects with helices. Used for inspection, by comparison, of screw threads and other irregular shaped parts up to 3 in. in diameter and 11 in. long between centers. Equipped for making lateral measurements, the BC-7 C has a 16 in. table which can be compounded

NEW Production and Plant EQUIPMENT

For additional information regarding any of these items, please use coupon on page 62.

for inspecting objects with helices. Objects up to 3 in. in diameter and 11 in. long between centers can be inspected. The range of magnifications in the BC-7 models is from 5 to 125.

The BC-14 Model with 14-in. diameter screen provides a larger lens field and screen area than the smaller



Jones & Lamson Model BC-14 D bench optical comparator and measuring machine

models, and has four table assembly combinations to choose from. The BC-14 A has a platform type table 5 in. by 10 in. for inspecting by comparison, a variety of objects on a production basis. The BC-14 B has a 16-in. table that can be compounded for inspecting objects with helices. The table elevates 1¾ in. vertically. The BC-14 C has a 16-in. table with 2 in. lateral travel that can be compounded for inspecting objects with helices. The table may be elevated vertically 1¾ in. The BC-14 D is used for the complete measurement of tools and products. The 16-in. table with 2 in. lateral travel, can be compounded for inspecting objects with helices and elevated vertically 1¾ in.

USAF Plans

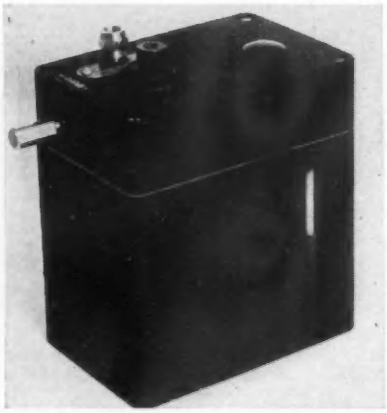
It is reported that the U. S. Air Force is planning to reactivate four wartime aviation projects in addition to 12 that already are operating under lease. The four additional projects would be at Wichita, Kan. where B-29 bombers were produced; the Curtiss-Wright foundry at Lockland, O.; a Fisher Body aircraft assembly plant at Cleveland; and a Douglas plant at Tulsa, Okla. Packard and the Allison Div. of GM are currently engaged in aircraft development.

NEW ★ PRODUCTS

For additional information regarding any of these items, please use coupon on page 62.

K-60—Automatic Lubricator

Bijur Lubricating Corp., Long Island City 1, N. Y., has brought out an automatic lubricator that provides a closely controlled oil feed for each bearing. Designed for installation within small machines, the Type "M" lubricator can effectively oil up to 100 bearings with measured regularity. Automatically driven by the machine, this cyclic unit develops an average discharge pressure of 40 psi, and discharges from 2.5 to 5.5 cc at each pump impulse.



Bijur Type M lubricator

Used in conjunction with a meter-unit distribution system, the Type "M" unit delivers small quantities of oil under accurate control to all bearings, gears and way surfaces of a machine at pre-determined intervals.

A completely automatic unit, this lubricator is driven from a rotating machine shaft, either directly or by means of a belt or gear drive of suitable ratio. Power requirements are negligible being of the order of 0.001 hp. The lubricator is available in several reduction ratios permitting the selection of the correct rates to accommodate the drive speed and the lubricator cycle time desired, and in both left-hand and right-hand drives.

Basically, the Type "M" lubricator is a two-part mechanism, consisting of a lubricator unit mounted directly on a reservoir. The mechanical unit consists of a cover supporting the drive shaft, reduction gear mechanism and pump. The metering pump is of the piston type and is actuated by a cam driven through a series of gears.

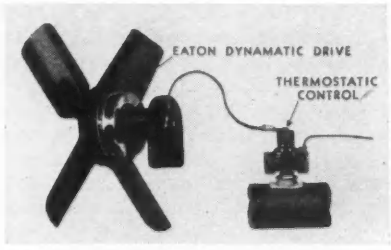
The pump unit of the lubricator may be mounted in a built-in reservoir integral with the machine to be lubricated, or it may be furnished complete with the standard reservoir. The reservoir is provided with an oil level sight gage. Tapped mounting holes in the base simplify installation in the machine. Volume of the standard Type "M" reservoir is 473 cc (one pint). Provision is made for disconnecting the pump unit from the reservoir and rotating it 180 degrees so as to change the relative location of the shaft projection with respect to the oil level gage.

K-61 — Dynamatic Fan Drive

The Eaton Manufacturing Co., Cleveland 10, Ohio, has placed on the market a Dynamatic fan drive for use on late model Ford engines in passenger cars and trucks.

The drive and fan assembly is bolted to the engine with the regular mounting bolts, and a variable-resistance thermostat is installed in the radiator return to the engine. This thermostat is capable of starting and stopping the fan as well as varying the fan speed in accordance with changes in water temperature.

Cooling system water passes through the radiator so that it receives all the cooling possible from impact air. If the air passing through the radiator by impact alone is not sufficient to cool the water properly before it returns to the engine, the thermostat starts the fan slowly, gradually increasing the fan speed until the water leaving the radiator is at the proper temperature. The thermostat follows the water temperature closely, causing the fan to run faster or slower or stopping it entirely in accordance with variations in speeds, load, and temperatures encountered, so that the water being returned to the engine is always at the proper temperature.



Eaton Dynamatic fan assembly

Starting and stopping of the fan as well as changes in its speed are not noticeable to the driver, as the Eaton Dynamatic drive follows the dictates of the thermostat without noise or any noticeable reactions.

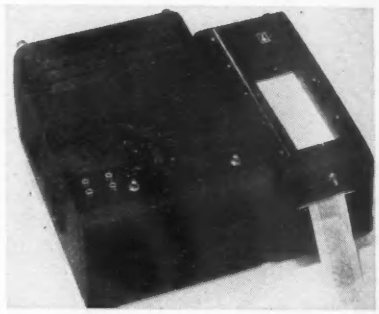
By using the Eaton Dynamatic fan with its controlling thermostat, the fan runs only when cooling is required and then only at the speed required to cool the engine under the particular temperature and road conditions being encountered. Thus the fan operates only a small fraction of the engine operation time and rarely at top speeds.

The new Eaton Dynamatic fan is an approved Ford accessory.

K-62—Strain Amplifier

The Brush Development Co., Cleveland, Ohio, is introducing a new strain amplifier, the Model B1-310. When used with the Brush magnetic direct inking oscillograph, it is a complete package unit for the measurement of strains. The equipment records either static or dynamic strains up to 100 cps, and direction as well as magnitude of the measured strain can be read from the chart.

The amplifier contains two legs of the Wheatstone bridge network. The third and fourth legs are connected externally by the user, one being the active gage, the other for sensitivity doubling, or temperature compensation. Resistance and phase balancing controls are provided on the panel of the amplifier. Provision is made for connecting an internal calibrating resistor in the bridge circuit and adjusting the overall gain. The analyzer is readily calibrated for individual gages, so that strain can be read directly in microinches per inch from the chart deflection.



Brush Model B1-310 strain amplifier

Although primarily intended for use with the SR-4 120-ohm strain gage, it is also applicable for use with any resistance-sensitive pickup. The instrument can be used for record pressures, temperatures, accelerations, forces, etc., provided the equipment is calibrated in terms of the particular pickup used.

The output of the amplifier consists of three stages, direct coupled, designed to match the characteristics of the direct-inking oscillograph. This section may be used as a general-purpose, low-gain, d-c amplifier with gain and centering controls provided. The amplifier may also be adapted for use with the Esterline-Angus or other similar graphic recorders.

K-63—Automatic Clutch for Small Motors

A recent development of Clark Clutch Division of All Steel Welded Truck Corp., Rockford, Ill., is an automatic clutch for gasoline engines and electric motors up to 5 hp.

The clutch is used on motor scooters both in conjunction with a variable sheave to provide an automatic transmission and as a single unit to provide an automatic clutch.

The clutch alone may be used on any application where it is desirable to start a motor or engine under no load and then pick up the load when motor or engine is up to speed. A feature of the clutch is that it may be adjusted to pick up a load gradually with no shock or it may be adjusted to pick up the load almost instantaneously when the prime mover has built up maximum torque.

Clark clutch and variable sheave mounted on motor scooter

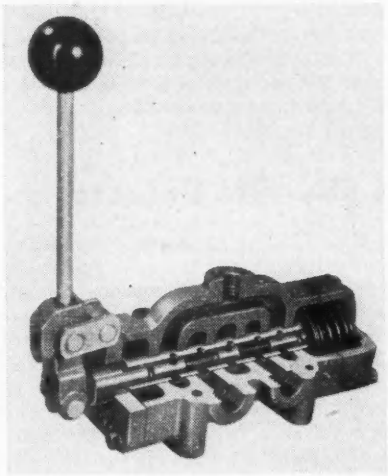
The Clark clutch also is inherently a torque overload release as it will slip if overloaded to a dangerous degree.

K-64—Four-Way Selector Valves

A new series of hydraulic four-way selector valves for industrial use is now in production at the Burbank, Calif., plant of Adel Precision Products Corp. The valves are designed for 1000 psi pressures for control of one double acting cylinder or two single acting cylinders. The spool-type construction permits a wide variety of porting arrangements for either open-center or closed-center hydraulic systems.

A feature of the Adel selector valve is the completely hydraulic balanced spool. The spool is completely balanced axially as well as radially so there is no possibility of spool movement caused by surge pressures in the reservoir return line. A dirt-excluding shaft seal keeps foreign materials from working into the valve mechanism. To fit particular requirements the standard Adel four-way valves are available with spring-centered, spring-offset or three position detent action. The valve is also equipped with interchangeable end caps to provide the placing of the operating lever at either end at any one of four radial positions.

The Adel valve offers a variety of models: Lever-operated for manual control; mechanically-operated for remote manual control; pilot-operated for remote hydraulic control; single treadle for foot control; solenoid-operated for remote a-c or d-c electrical control; and Camroller operated for automatic control. It is manufactured in ¼-, ⅜-, ½-, ¾- and 1-in. pipe thread port sizes with flows to 32 gpm.



Cut-away view of Adel four-way valve

K-65—Piston Rod Packing

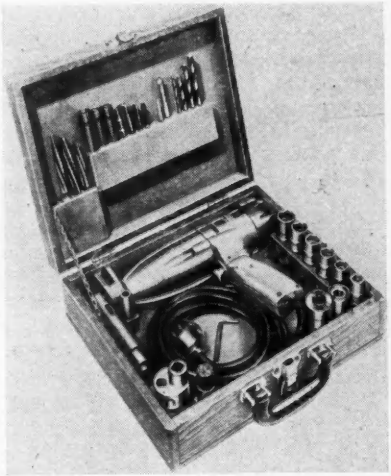
The Quaker Rubber Corp., Philadelphia 24, Pa., has developed a special type of packing for sealing piston rods of drop forge hammers. Called Daniel's P. P. P. Special No. 183, this unique packing is said to offer tight-sealing plus long, trouble-free service as the sliding-wedge action readily absorbs severe vibration without breakdown. This sliding-wedge design causes packing to tightly seal itself against piston rod when pressure is applied, eliminating leakage of steam and condensation "drip". When pressure is released on the return stroke, packing returns to its normal shape, thus reducing wear and friction. Packing is self-lubricated and will not harden nor dry out.

NEW ★ PRODUCTS

For additional information regarding any of these item, please use coupon on page 62.

K-66—Impact Tool Kit

A portable, all-purpose impact tool kit has been added to the line of Ingersoll-Rand Co., New York 4, N. Y. The kit includes the new electric impact tool—with standard accessories for nut-running and nut removal, for drilling steel, masonry or wood, reaming, wire brushing for carbon-cleaning jobs, and equipment for applying and removing studs, tapping, driving and removing screws. The impact tool weighs only 6-1/2 lb, and performs all of these jobs using standard attachments.



Ingersoll-Rand impact tool kit

The kit is assembled complete or with accessories as required. With standard equipment, the kit contains the impact tool with a Jacobs collet type chuck, six hex sockets of varying sizes, a Morse taper socket, and adapter sleeve.

The impact tool is available with either 110-volt or 220-volt motors.

Drop In Ford Model T Parts Sales

The faithful old Model T Ford is rapidly disappearing from the nation's highways. At least that is the indication from the volume of parts sales by Ford for the six months period ending Jan. 1, 1947. Sales of Model T parts for the period totaled only $33,866, accounted for by more than 115 items. Current consignments abroad average only $20 a month.

NEW PRODUCTS FOR AIRCRAFT

For additional information regarding any of these items, please use coupon on page 62.

K-67—Device to Record Horsepower Hours

To eliminate guesswork in the measuring of engine usage and wear, "Power-Recorder," the first device of its kind, has just been introduced by the Kollsman Instrument Division, of Square D Co., Elmhurst, N. Y. By recording the cumulative power-hour units turned out by an engine, the new Power-Recorder provides approximate measurement of total engine wear.

In aircraft engines the Power-Recorder computes the total power-hours produced by continuously measuring the engine speed, manifold pressure and atmospheric pressure. Power data are obtained in accordance with the engine power curves for all throttle and propeller pitch settings and altitudes. The rate at which the power units are registered is directly in proportion to the power-hours delivered by the engine. For the aircraft operator's convenience the results are given in terms of equivalent hours at cruising power, thus registering 100 units per hour if the airplane is flown at normal cruising power.

The Power-Recorder answers a need in the case of aircraft rental operators so that customers can be accurately charged for engine-service time. An hour at full throttle may take as much out of the life of an engine as two to four hours at an easy cruise, yet at present it is customary to charge for the airplane only on an hourly basis. If the normal cruising power of an airplane is 70 per cent of maximum power, then, for full throttle at sea level the Power-Recorder would give 143 units per hour. However, if it is desired to penalize the pilot more for pushing the engine too hard, the Power-Recorder can be calibrated to give higher values for high power operation, as for example, 200 units per hour for full throttle. On the other hand, where the pilot is just out for a ride, enjoying the quiet of throttle-back cruising, the Power-Recorder will show only 60 or 80 units per hour.

Two types of Power-Recorders have been developed; one with a flexible shaft connection to the engine tachometer outlet, and another a remote operating type which is electrically driven by a tachometer generator mounted on the engine tachometer outlet. For uses other than aircraft, the device can be calibrated in any convenient units, such as horsepower-hours.

The Power-Recorder prints the cumulative power units and the engine identification number in the manner of a time-clock so that the record can be filed for reference.

It can also be supplied with a visual counter-type indication in the place of the printing mechanism.

K-68—Fire Detector

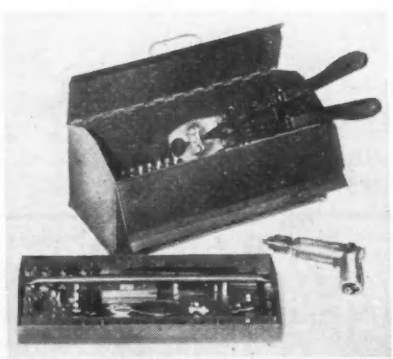
The CPI fire detector, a product of Control Products, Inc., 306 Sussex St., Harrison, N. J., will operate the fire alarms signal at a preset temperature. When subjected to test under conditions of the current specifications, it will actuate the alarm under the allowable five seconds when exposed to a direct flame of 2000 F and will indicate fire out equally fast. Even after repeated shots of 60 seconds each at 2000 F stability of calibration within a very close percentage is maintained, according to the maker of the device.

K-69—Tool Kit for All-Metal Planes

A specially assembled aircraft sheet metal kit for servicing on any all-metal plane is being introduced by Aircraft Tools, Inc., of Los Angeles. The kit is said to contain every tool or accessory required for sheet metal work on planes, 202 tools in all, compactly encased in an all-steel portable box.

In the style of a kit designed for fishing tackle, the box has an upper tray, easily removable, for smaller tools and accessories. The roomy bottom easily accommodates the larger size items, and the drop-front of the kit makes it simple to get at any tool desired. Small tools used with a set combination of accessories are in canvas kits with pockets for the accessories.

The kit contains such tools as Aircraft Tools' flex shaft with angle drill head for close quarter drilling, combination square, pork chop, drill adapters, micro-stop countersinks, skin clamps, speed driver kit, Cleco air hammer, Chicago pneumatic air drill with Jacobs chuck, full range of rivet sets, bucking bars, an assortment of cutters and hole saws, hand rivet squeezer sets, cup squeezer sets, junior spot facers, drill-out tools, Lufkin tape measure, tool box with tray drills, and all other tools needed for sheet metal work on planes.



Tool kit made by Aircraft Tools, Inc.

K-70 — Adjustable Footrest

A new footrest that is easily and quickly adjusted to meet the exact requirements of the tallest man or the shortest woman is now being incorporated in new Hardman Airliner lounges, according to the manufacturer, Hardman Manufacturing Co., South Gate, Calif.

The Hardman footrest supports the feet in their natural position. In order to give such support to passengers of different heights, the footrest is equipped with rollers that operate in a channel permanently fixed to the lounge in front of the passenger. The range of travel is approximately eight in.

A button releases a lock and the footrest is forced to its outer limits toward the passenger by pressure of a shock cord. The passenger then pushes the footrest to the correct position and releases the handle.

K-71 — Motor-Operated Gate Valve

Hydro-Aire, Inc., Burbank, Calif., has designed and developed a 1¼ in. motor-operated, 28 volt d-c gate valve weighing only two lb, which operates, open or closed, in one second at pressures up to 300 psi.

Ease of maintenance was designed into the unit in that "O" ring seals can be replaced by removing two snap rings. The electrical portion of the unit is supplied as a self-contained package consisting of motor, limit switches, receptacle and wiring, mounted on the cover plate. This electrical package can be replaced without removing the valve from its bracket or attaching-lines, by removing five screws. No additional adjustment is necessary after placing the electrical package in its proper position on the valve.

The valve can be used as a shut-off in air, fuel, engine oil and hydraulic oil systems.

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joints and other connections with needle bearings.

Results of the Krzhivitskii Report

The impact of this study of Lend-Lease vehicles on Soviet specifications and designs has been profound. It brought about adoption of several features that had been introduced on a partial scale prior to the war: exhaust-valve seat inserts, crankcase ventilation, thermostats, worm-and-roller steering gear, and 12-volt electrical systems. It also forced corrections of glaring deficiences such as the previous absence of hydraulic brakes, fifth speeds for heavy trucks and comprehensive filtration systems. It focused attention on POL and cold-weather operation problems that had previously been neglected.

At the same time, many of the most important recommendations have not yet been realized. Neither the GAZ-AA or ZIS-5 has ceased production. Fuel and lubricants, despite corrective efforts during the war (with Lend-Lease aid) remain exceedingly poor. Little of the fundamental re-design of engines for better serviceability and winter operation has been placed in production.

Postwar Research

Since the war, the level of automotive research has been considerably higher than in the pre-war era. Much more attention is being paid to experimentation and measurement on a statistically significant scale; the existing deficiencies in testing equipment and facilities are being realized and gradually corrected. Yet narrowness in approach and arm-chair analysis continue to vitiate much work. Current problems include the economics of automobile transportation and the economy of gasoline.

The economics of automotive transportation is a special field of the Central Scientific Research Institute of Automotive Transport. Specific current projects include estimation of the types and numbers of motor-vehicles required for each division of the national economy; development of a plan for a net of service stations; formulation of a system of uniform preventive maintenace for the entire USSR; and specification of standard tables of organization for various sizes of truck fleets—5, 15, 25, 50, 100 and 200 trucks—including operating structure, command organization, the administration of planning and work computation, hauling, maintenance and repair, labor and pay, etc. The actual functioning of the standard organizations is also being investigated in connection with the short-haul trucking of the Moscow Railroad District.

In the economy of gasoline, the development of measuring devices for regulating carburetors, fuel pumps, etc., by the Central Scientific Research Institute of Automotive Transport has been credited with achieving an economy of 10-12 per cent in the national consumption of gasoline. In the period 1942-45, the Institute produced 1500 such devices to the Red Army alone.

The other lines of effort to secure economy of gasoline have concentrated primarily on substitutes and adulterants. One wartime "development" was the use of gasoline-kerosene mixtures for this purpose.

Garage Equipment and Automotive Repair

The USSR is finally beginning development and manufacture of garage equipment, including hydraulic jacks, ammeters, spark plugs testing, devices, wheel-adjusting devices, etc. The Ministry of Machine and Instrument-Building and the Central Scientific Research Institute for Automotive Research are primarily concerned in this program. A number of other organizations are also cooperating in preliminary work on new repair techniques, such as the application of induction hardening.

Engine Wear

Extensive work on engine wear has continued since the tests of Lend Lease vehicles during the war focused Soviet attention on this problem. The most recent tests at GAZ have shown that the use of cylinder inserts is the decisive factor inhibiting engine wear, reducing it up to 80 per cent. The use of propane-butane gases as fuels is also encouraged by these studies, since these gases also reduced engine wear, in most cases by 30-50 per cent in comparison with Soviet gasoline.

Gas-powered Vehicles

Increasing efforts are being directed to the development of propane-butane, natural gas, methane and other gas fuels. The recent Berlin-Moscow run of 10 gas-powered vehicles has indicated the superiority of specialized engines for this purpose. A Bussing NAG bus with such an engine (six cylinders, 7.4 compression ratio, 115 hp) operated during this run both on propane-butane (with a Hessenwerke DM-100 adapter) and on compressed 92-94 per cent methane (with a Solex LR-3 adapter). This bus, with its trailer, had a gross weight of 39,100 lb and consumed 28 to 34 cu ft of methane or 1.27-1.42 lb of butane-propane per mile. In comparison, ZIS-5 trucks with a gross vehicle weight of 13,420 lb consumed 15.4 to 16.1 cu ft of methane per mile (with Hessenwerke DM-100 adapter), and 0.89 to 0.99 lb of butane-propane per mile (RSU-2M Soviet adapter). Thus employment of a specialized engine as compared with an ordinary gasoline engine plus adapter demonstrated a gross-vehicle weight/fuel consumption economy of over 33 per cent with methane and over 50 per cent with butane-propane. These findings may wel lopen up a new trend in Soviet engine design culminating in the adoption of a Hesselman or other type of multi-fuel engine.

Metallurgy

GAZ and ZIS, in cooperation with various steel plants, have initiated experiments to improve Soviet metallurgical techniques on lines largely laid out by American and German precedent. Work in progress or contemplated includes investigation of porous chrome plating for piston rings, tempering at temperatures below 0 C, powder metallurgy, cyanided steel, etc.

One series of tests which appears to be promising is the development of chrome-manganese-titanium steel for automotive gears. This steel (18 KhGT), is currently being produced at Zlatoust Metallurgical Plant. Its composition comprises 0.17-0.24 per cent C, 0.9-1.2 per cent Mn, 1.0-1.4 per cent Cr, less than 0.3 per cent Ni, and 0.05-0.15 per cent Ti. The base alloy is heated in a 50-ton marten oven until oxidation has ended, then warm ferro-titanite is added. Hot-rolled rods of this alloy, which have been cooled to 120-125 C, have a hardness of d_b=3.8-4.2; the small grain structure of the metal prevents gas bubbles or cracks. The annealing qualities are adequate for gear teeth, up to a critical diameter of 50 mm. After annealing in oil at 880 C and tempering at 200 C, core hardness in rods of 15-20 mm diam is R_c=37-40; in rods of 30-50 mm diam, R_c=28-32. Adoption of this alloy would permit lowered Soviet consumption of nickel, molybdenum and vanadium, all critically short.

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AI	Automotive Industries, The Chilton Co., Phila.
AP	Automobilnaya Promyshlennost (Journal of the Automobile Ministry of the USSR; successor to Avto-Traktornoye Dyelo) Moscow.
ATD	Avto-Traktornoye Dyelo (Journal of the Main Administration of the Auto-Tractor Industry) Moscow.
VMS	Vestnik Mashinostroyeniya (Journal of the Ministries of Heavy-Machine Building, Automobile Industry, Transport - Machine Building and Machine- and Instrument-Building) Moscow.

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Canada

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in direct ratio to their increase of production for export.

No permit is required for casual imports, valued at $25 or less, or for any parts or accessories which were in continuous and uninterrupted transit to Canada on or before February 29. Provision is also made to exempt parts used for emergency repairs by travellers outside the country.

It was ruled that imports from January 1 to February 29 would be chargeable against the total dollars allotment for 1948, and that this annual allotment may not be used at a greater rate than 25 per cent per quarter on a cumulative basis. For example, if only 15 per cent of the allotment is used in the first quarter, then it is permissible to use up to 35 per cent in the second quarter, and so on.

Importers of service and repair parts will receive a dollar allotment amounting to 75 per cent of the cost of their imports of similar products during the 12 months ending Oct. 31, 1947.

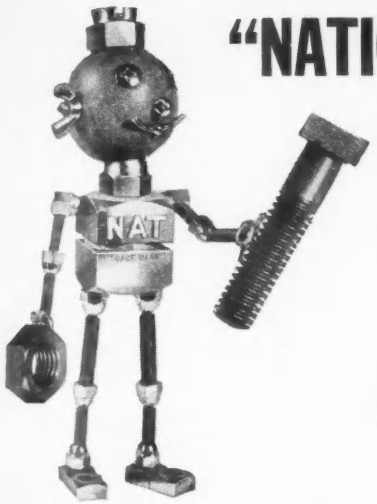
Manufacturers of passenger cars seating 10 persons or less, and trucks of less than 16,501 lb manufacturer's gross vehicle weight rating, will in addition receive an allotment based upon the cost of imported parts used by them. This is calculated to average $307 per vehicle.

Using this average cost of imported parts, the allotments for the year 1948 are calculated by adding together, (1) the number of vehicles manufactured for domestic use during the basic period multiplied by $230 (i.e. 75 per cent of $307), and, (2) the number of vehicles produced for export during the basic period multiplied by $307.

Manufacturers may further use the whole or any part of the allotment, to which they are entitled as importers of complete vehicles, for the importation of parts for manufacturing in Canada.

In addition to the foregoing, each manufacturer will receive a further allotment equal to 55 per cent of the amount by which his exports during the year 1948 exceed 90 per cent of his exports during the basic period. It is calculated that the 55 per cent of additional returns from export will amount to approximately twice the cost of imported parts in the average unit produced, and will thus provide an incentive to increase production for export.

Application forms for parts and accessories imports from the scheduled countries also may be obtained from the Collectors of Customs at the larger centers throughout Canada, or direct from the Capital Goods Emergency Import Control Division of the Department of Reconstruction and Supply. Imports from non-scheduled countries will require individual permits for each shipment of parts and accessories.



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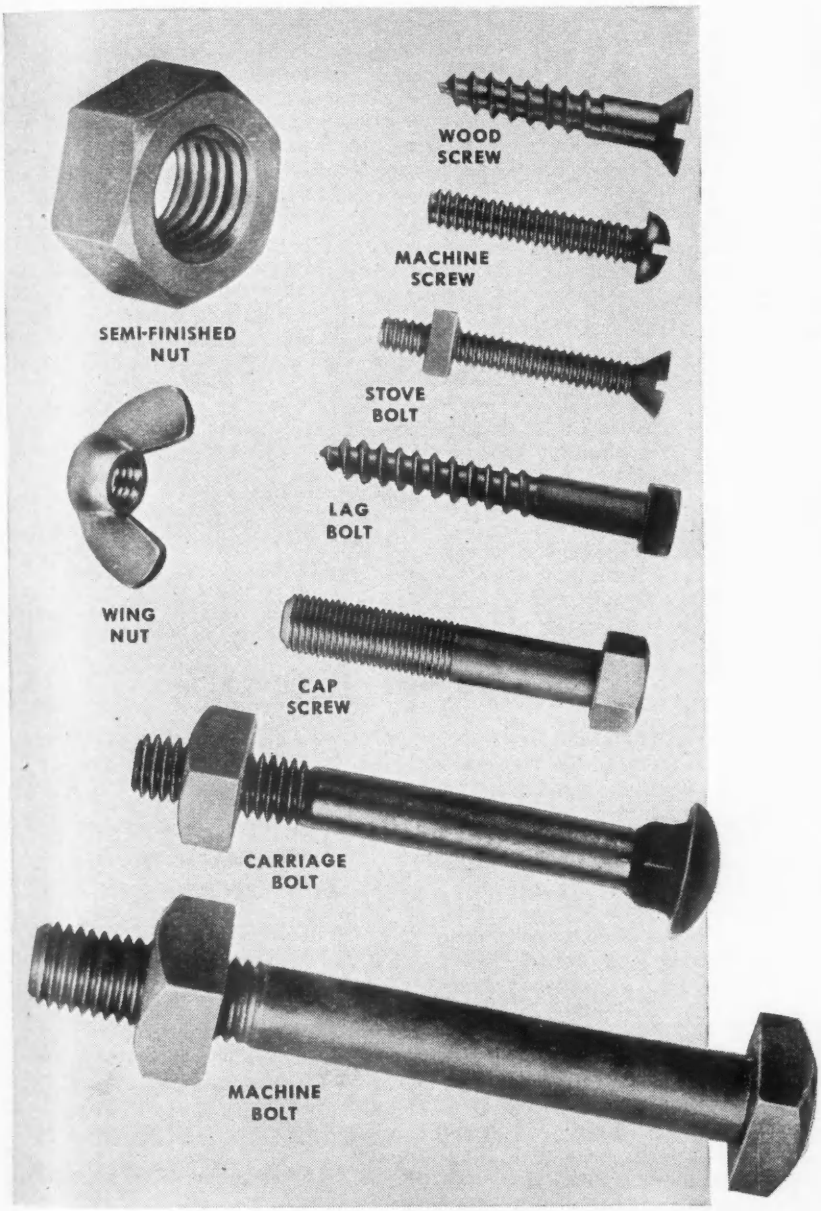
Makes your buying EASIER



You can buy all your headed and threaded fasteners from one source when you order from "National". For standard bolts, nuts and screws, or special fasteners to meet your individual problems, "National Screw" has the facilities to make every type of fastener you require.

With its wide variety of manufacturing equipment, "National" is the only manufacturer who makes all of the fasteners illustrated here. Also, "National" makes tacks, rivets, cotters, tapping screws, plow bolts, locknuts and many other fasteners.

For the products you manufacture, "National" can supply you with the right fasteners to make your products fit better—stay tighter—or operate more smoothly.

Dependable Uniform Quality

Note the well-formed heads and clean, sharp threads on these bolts and screws. The nuts are uniformly well-made to give a smooth, even fit.

National
FASTENERS
PRODUCTS

THE NATIONAL SCREW & MFG. COMPANY, CLEVELAND 4, OHIO

Demand for Petroleum Products

(*Continued from page* 41)

years is predicted, compared with a fourfold increase over the past 25 years. Of particular interest is the continuing expansion in demand for motor fuel and distillate fuels, and the diminishing demand for residual fuel. Residual fuel oil, such as is used in large industrial installations, is normally produced as a by-product in the manufacture of gasoline, kerosene, Diesel fuel, and so forth. In general, the yields of residual fuel oil have been dictated by the techniques available for refining. By such a process as catalytic cracking, gasoline and distillate fuel yields can be increased at the expense of residual fuel oil. Processes are even available whereby petroleum can be refined completely to gasoline and distillate fuels, with no production of residual fuel oil.

The current demand for residual fuels, however, is such as to require the deliberate diversion to residual fuels of crude-oil fractions capable of refining to lighter products. With ever increasing demands for petroleum and with continually rising costs for locating and producing crude oil, it may be expected that in the future the price of petroleum will establish itself at such a level that the deliberate diversion of crude to residual fuel oil will be uneconomical. It will then become necessary for other fuels, particularly coal, to assume an increasing proportion of the nation's industrial-fuels load. That will be in the nation's interest and will lead to the conservation of petroleum for the production of liquid fuels for use in fields where there are no satisfactory substitutes.

By 1970 about 7,130,000 bbl a day of crude oil or its equivalent will be required to meet the demand. Where, then, is all this liquid petroleum to come from?

First, the United States is currently producing more than ever before. Crude-oil production averaged about 5,000,000 bbl a day—(actually it hit 5,230,000 bbl per day in October) plus about 357,000 bbl per day of natural gasoline and benzol, plus imports (mostly from South America) of about 430,000 bbl per day. These imports just about balanced exports of finished petroleum products. This domestic production of crude oil at the October, 1947, rate of 5,230,000 bbl per day was nearly six per cent over the World War II peak production, and natural gasoline extracted from gas had increased an even greater extent. In spite of these figures, proved crude-oil reserves increased five per cent between 1945 and 1946, and reserves of natural gasoline, condensate, etc., rose still more. Total proved reserves of both crude and condensate stood at 24 billion, 227 million bbl at the end of 1946. (In discussion following presentation of the paper, Mr. Gunness estimated proved reserves would last about 15 years, even if there were no further exploration—Ed.)

It remains to be seen whether the race on the part of oil men to find and produce more crude petroleum in this country can keep pace with the ever-increasing demand for liquid fuels. The U. S. has imported some oil from South America for years, and can import more. American oil companies are striving to develop large new supplies in the Middle East and to install pipe lines to bring these supplies to market. To develop the Middle East production further will require steel and equipment from the United States, but such development is justifiable from the standpoint of national economy, even if the exporting of equipment means foregoing the immediate development of additional domestic reserves.

The most likely first source of synthetic liquid petroleum is natural gas. The cost of a plant to produce liquid petroleum from natural gas is currently estimated—depending on the authority—at $2500 to $4000 or more per daily barrel of liquid product. This assumes a supply of gas is available and ready for delivery to the plants. To synthetically produce only a million barrels a day of petroleum—which is less than one-fifth of U. S. current needs—would require an investment of many billions of dollars. Assuming the economic urge, plenty of construction materials and manpower, and a peaceful environment in which to work, such a program is only possible over a period of years.

Liquid fuels can be synthesized from coal as well as from gas. However, this cannot be done as rapidly or as cheaply, and it cannot be done at all unless new mines are opened and staffed with miners yet to be trained. Bureau of Mines computations indicate that, for production of 10,000 bbl per day of synthetic petroleum, 6500 tons of coal of 12-13,000 Btu per lb would be required. To produce a million barrels of oil a day from coal—that is, about one-fifth of current requirements—would require the erection of plants costing, say five billion dollars; and such plants would consume 650,000 tons of coal per day or about 236,000,000 tons per year. The cost of opening new coal mines is estimated at $5 to $8 per annual ton, which would add another billion or so dollars to the total estimated cost. The nation's entire production of bituminous coal for 1941 was reported at 511,000,000 tons. To produce all of the present 5,000,000-bbl daily demand for petroleum products from bituminous coal would necessitate—among other fantastic requirements—twice as much bituminous coal as was mined in 1941; and even that enormous production would leave no bituminous coal to be burned as coal.

The quantities of synthetic liquid fuel that will probably be produced by synthesis is apt to be small for several decades, and its rate of growth will depend on the law of supply and demand. In any event, it appears unlikely that economics will permit liquid fuels synthesized from coal to compete for markets in which the direct use of coal is an alternative.

The production of large quantities of oil from shale and tar sands seems considerably more remote than from synthesis. The processes of separation, particularly in the case of shale, are by no means impracticable, and the construction costs of plants to extract and refine the products may easily be less than for synthesis from coal. But the mining and handling of the necessarily great quantities of shale are bound to be expensive when it is considered that, to get a barrel of crude shale oil, more than a ton of material must be dug up and moved through the plant, and the remainder must be carted somewhere else for disposal.

Table I—Total Demand, Domestic and Foreign, for U. S. Petroleum Products

(Thousands of Barrels Per Day)

	1947	1941	Increase
Motor Fuel	2290	1910	380
Distillate Fuel	880	520	360
Residual Fuel	1430	1090	340
Kerosene	300	200	100
All Other	950	650	300
Total Demand	5850	4370	1480

Table II—Estimated U. S. Gasoline Demand in 1970

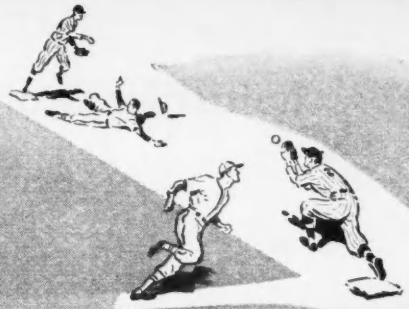
	Thousands of Barrels Per Day
43,000,000 passenger cars	1970
7,100,000 commercial vehicles	720
4,000,000 tractors	130
Aviation gasoline	180
Naphthas	70
Miscellaneous	90
Total	3160

Table III—Estimated Domestic Demand for Petroleum Products in 1970

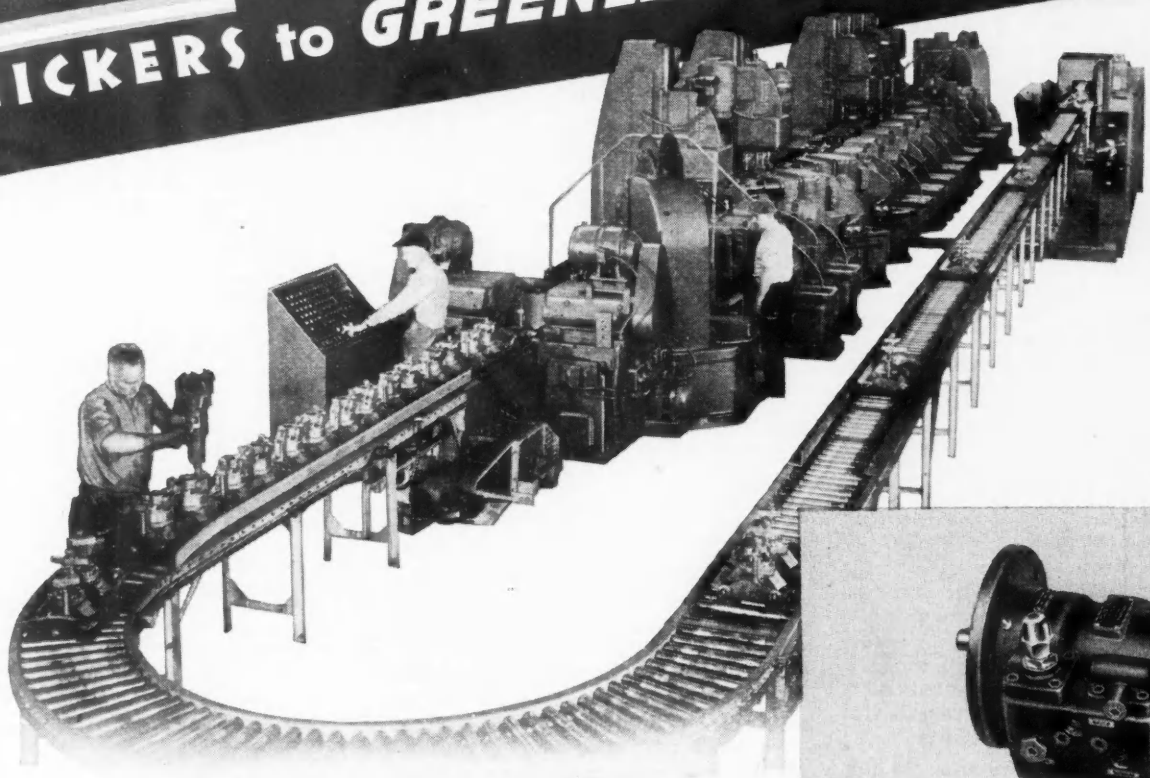
(Thousands of Barrels Per Day)

	1970	1947	Increase
Motor Fuels (see Table II)	3160	2160	1000
Distillate Fuel	1350	790	560
Residual Fuel	1270	1410	—140
Kerosene	440	280	160
All Others	910	750	160
Total Demand	7130	5390	1740

A Cost-Cutting DOUBLE PLAY



VICKERS to GREENLEE to *Kelvinator*



This 24-station, 152-tool Automatic Transfer Processing Machine was built by Greenlee Bros. & Company to aid Kelvinator in reducing the cost of machining refrigerator compressor bodies. With the many machining operations involved on these high-production parts, work handling is as important as metal cutting in obtaining a low cost.

All functions of the machine are accomplished with the aid of Vickers Hydraulic Equipment . . . and all of the pumps and control valving were supplied to Greenlee by Vickers. Two types of pumps are used in the installation for transfer and unit head operation. The pump for operating the unit heads is shown at the right.

Consult the Vickers Sales Engineering office in your area for information on how Vickers Hydraulic Equipment can be applied to meet your requirements.

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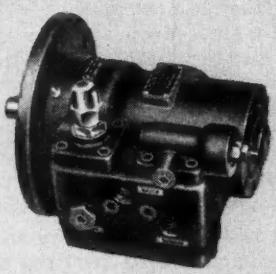

VICKERS BALANCED VANE TYPE PUMP

This efficient and dependable source of hydraulic power has a number of extraordinary advantages that improve the product upon which it is used. The exclusive *hydraulic balance* construction prolongs pump life by entirely eliminating bearing loads resulting from pressure. Automatic wear take-up is provided without appreciable change in performance and correct running clearance is automatically maintained throughout wide temperature range with its resulting differential expansion of pump parts. For the many other features, ask for Bulletins 38-14 and 40-25a.

3435

Latest Uses of Alloy Steels In Motor Vehicles

(*Continued from page* 27)

If the problem of application amounted only to a selection of the proper type of steel to meet end use requirements, it would be relatively simple. The real problem, however, lies in making the final decision as to what must be sacrificed to achieve a satisfatcory compromise. A designer must, therefore, consider: the ease with which the steel can be manufactured, rolled, or forged; ease of annealing and machining; kind of heat treatment necessary; relative economics of one grade of steel as compared with the others; possibility of design changes to permit the use of some standard grade of steel rather than requiring a special product; and necessity for a new grade of steel to meet an unusual situation. Formerly, new types and grades of steel were required quite frequently. Today, with more advanced knowledge of metallurgy and the posssibilities of heat treatments, together with the wide range of standard steels available, it is seldom necessary to specify a new steel.

A large percentage of the steels now used in the automobile field obtain their desirable physical characteristics by heat treatment. It is not essential that they harden throughout to 100 per cent martensite, but rather that the 100 per cent martensitic microstructure be attained on those surfaces subjected to the greatest unit stress and wear. These steels are generally used in a tempered state, since tempered martensite provides ample strength together with the desired ductility.

It is seldom that more than 50 per cent martensite is required at the center of a section and, by means of the Jominy end quench test, this degree of hardenability may readily be specified. In fact, a large number of the alloy steels now commonly used may be purchased on the basis of hardenability bands so that the results of heat treatment will be less variable. These "H" steels, as they are known, do not, however, permit the designer to disregard such features as: effect of residual stress in large sections caused by excessively deep hardening; limitations of carbon content effecting higher hardness values than neecssary, thereby contributing to unnecessary residual stresses in large sections; "stress-raisers," such as insufficient corner radii; effect of character or smoothness of surface in members subject to sudden shock loads or fatigue from torsional loads or bending stresses; the effect of shot-peening or cold working of surfaces to improve endurance limits; or effect of an alloying element on retarding or facilitating the transformation of austenite into lamellar pearlitic microstructures considered desirable for machining.

A somewhat different problem is involved in the case of carburizing steels. Here the designer must consider both hardenability and the effects of the alloying elements upon the ultimate mechanical properties to an even greater degree than with the constructional alloy steels. Hardenability must be such as to produce required core strengths, hardness and ductility, as well as to assure the properties and microstructures required in the high carbon carburized and fully hardened case.

Case toughness at high hardness can be assured by the use of nickel, by a combination of nickel and molybdenum, or by a combination of chromium, nickel and molybdenum. The chromium and molybdenum are needed to produce proper carbides of the correct size and distribution for wear resistance; nickel and molybdenum impart toughness. Thus, for pin and bushing applications or other lightly-stressed high speed gears or bearings, where resistance to wear is the primary consideration, chromium or molybdenum only are needed. For gears and bearings subject to medium stresses and shock loads, but requiring good wearing qualities, nickel and molybdenum, chromium and nickel, or low chromium-nickel-molybdenum steels may be used. In the case of heavy-duty gears or bearings subject to the highest stresses, severe shock loads and maximum wear, high nickel, high nickel-chromium, or high or medium chromium-nickel-molybdenum steels should be used. Principal applications of alloy steels in passenger cars, trucks, tractors and buses are shown in Tables I, II and III.

The U. S. S. SuperKore steels listed in Table III represent a new series of deep hardening carburizing steels designed to meet the need for easily fabricated truck, tractor and bus gears, shafts and pinions subject to heavy duty service. They were designed on the basis of wartime experience with the manufacture and application of the NE steels and make most efficient use of the alloying elements. Their physical properties are such as to enable them to replace more highly alloyed carburizing steels such as the 3300, 4300, 4800 and 9300 types, and because of their improved carburizing, annealing and machining characteristics, it is frequently possible to effect economies in production costs through easier machining and freedom from warpage.

Business in Brief

Written by the Guarantee Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES.

Minor reductions in general business activity are indicated. The *New York Times* index for the week ended Mar. 6 stands at 151.7, as against 153.5 for the preceding week and 144.2 a year ago.

Sales of department stores during the week ended Mar. 6, as reported by the Federal Reserve Board, equaled 265 per cent of the 1935-39 average, as compared with 248 in the week before. Sales were four per cent above the corresponding distribution a year earlier, as against a preceding similar excess of the same amount. The total in 1948 so far reported is six per cent greater than the comparable sum in 1947.

Electric power production increased in the week ended Mar. 6. The output was 10.6 per cent above the corresponding amount in 1947, as compared with a similar advance of 9.5 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 792,571 cars, 0.2 per cent more than the figure for the week before but 1.6 per cent below the corresponding number recorded in 1947.

Crude oil production in the week ended Mar. 6 averaged 5,352,900 barrels daily, or 34,223 barrels less than the preceding average but 529,000 barrels above the comparable output in 1947.

Production of bituminous coal and lignite during the week ended Mar. 6 is estimated at 13,025,000 net tons, 100,000 more than the output in the week before. The total production in 1948 so far reported is 7.1 per cent below the corresponding quantity in 1947.

Civil engineering construction volume reported for the week ended Mar. 11, according to *Engineering News-Record*, is $95,996,000, or 48 per cent less than the preceding weekly figure and seven per cent below the comparable sum in 1947. The total recorded for 11 weeks of this year is 17 per cent more than the corresponding amount in 1947. Private construction is 18 per cent below that a year ago, but public construction has increased by 89 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended Mar. 6 is 160.4 per cent of the 1926 average, as compared with 159.2 for the preceding week and 148.7 a year ago.

Member bank reserve balances decreased $186 million during the week ended Mar. 10. Underlying changes thus reflected include a decline of $525 million in Reserve bank credit and a reduction of $203 million in Treasury deposits with Federal Reserve banks, accompanied by a decrease of $18 million in money in circulation.

Total loans and investments of reporting member banks declined $563 million during the week ended Mar. 3. A reduction of $51 million in commercial, industrial and agricultural loans was recorded. The sum of these business loans, $14,540 million, shows a net increase of $2630 million in 12 months.

USER REPORT:

"Our first Warner Electric Brakes were purchased over twenty years ago and some of the original brakes are still in operation"

ROYLE R. FREER, President
Freer Motor Transfer Company, Inc.
Chicago, Ill.

July 22, 1947

Warner Electric Brake Mfg. Co.
Beloit, Wisconsin

Gentlemen:

Forty pole and flat bed trailers in our fleet are equipped with Warner Electric Brakes. These trailers operate more than a million miles a year throughout Indiana, Illinois and the City of Chicago, hauling structural steel and steel from the various mills.

Our first Warner Electric Brakes were purchased over twenty years ago and some of these original brakes are still in operation. We are thoroughly convinced that the low original and maintenance cost cannot be surpassed by brakes of any other type.

Our service manager, Mr. John V. Lindholm, has been servicing Warner Electric Brakes on our equipment since the first pair was purchased. He is truly a Warner booster.

Our experience with your brakes has been very satisfactory and we felt that you would appreciate learning these facts.

Yours very truly,
FREER MOTOR TRANSFER COMPANY, INC.
Royle R. Freer
Royle R. Freer
President

RRF/lh

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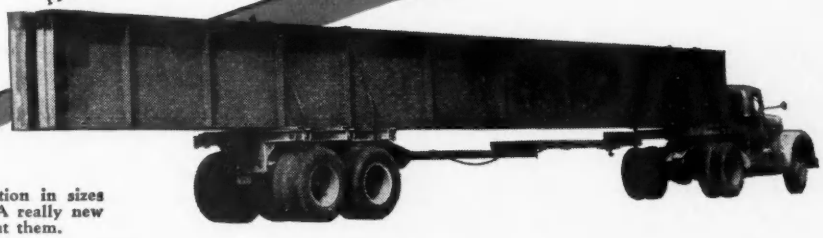
NEW!



Warner Electric Brakes of 2-shoe construction in sizes 16½" x 5", 16½" x 6", and 16½" x 7". A really new concept of super-stopping power. Ask about them.

Hauling structural steel on forty-pole and flat bed trailers over a million miles a year is record-breaking performance. Dependable, positive braking is a "must" on this gigantic operation. Warner Electric Brakes have been giving incomparable service on these huge trailers for over 20 years.

And for good reason! Because Warner Electric Brakes are *specifically engineered* to meet every trailer braking need. No other brakes equal their rugged construction, long lining life, positive control and dependable performance, even under the most severe conditions of heat, rain, snow, ice, and cold.

CHECK YOUR BRAKE PERFORMANCE AND MAINTENANCE COSTS!

If you want maximum safety plus economical performance, standardize on Warner Electric Brakes. Write for illustrated literature explaining their many advantages.

WARNER ELECTRIC BRAKE MFG. CO.
BELOIT, WISCONSIN

WARNER
ELECTRIC BRAKES

SINCE 1927

Extrusion Forging

(*Continued from page* 40)

data are reproduced in the next column comparing the present upset-and-hammer forging method and the proposed extrusion technique. The productivity for each setup given below is the same.

It will be noted that the present method produces two spindles at a time, using a 15-lb billet. This makes two machined spindles, each weighing 3.70 lb. The new method extrudes one piece at a time, using a rough-sheared round billet weighing only 5¼ lb. To make two pieces the new technique requires only 10½ lb of billet steel as compared with 15 lb for the old method, representing a saving of 4½ lb of raw material or 2¼ lb per piece. Assuming a production rate of say 9000 pieces per day, this means a saving of 20,250 lb or 10.125 tons of steel per day.

The actual saving is tied up more with the reduction of materials handling, and greatly decreased metal removal in the machine shop than with a saving in material cost since much of the excess can be recovered as scrap. On the other hand considering the current shortage of steel, the new method will make it possible to produce the required output with only 23.6 tons of billet per day as contrasted with 33¾ tons with the old method, or an additional 3800 pieces per day could be made using the total amount of stock required with the older method.

The simplicity of the extrusion process is best exemplified by contrasting the lineup of equipment and operations with the old process; and the significant reduction in floor space and operating personnel. From a cost accounting standpoint the reduction in overhead burden is remarkable. Another significant claim is that the extrusion process also has precision possibilities quite analagous to that of coining with the result that forgings can be made closer to rough machining tolerances. Not only does this make possible the amazing reduction in billet size but an even greater economy due to the reduction in metal removal.

In addition to production economy, there is likewise a similar gain from an engineering standpoint in the improvement of microstructure and enhanced physical properties which appear to be a definite consequence of the extrusion method. As illustrated, the microstructure of the extrusion marks a great improvement over the conventional forging in the development of flow lines and their pattern; and in density—with its freedom from porosity. These criteria, in turn, are reflected in better physical properties as gaged by an increased endurance limit. The result of a number of laboratory tests on specimens of extruded and forged samples is given below:

The test results on three extruded and three forged spindles all made from the same original bar stock, Type "AAA" steel, are tabulated below.

	Cycles to Failure	Brinell Hardness Core	Brinell Hardness Back
Extruded:	440,200	269	311
	352,300	269	321
	261,900	269	311
Average	351,500		
Forged:	139,200	285	321
	215,300	277	321
	235,400	285	321
Average	196,700		

Comparing these data it will be noted that the average endurance limit for extruded samples is 351,500 cycles while the limit for the conventional forged samples is only 196,700 cycles. This is an increase in durability of almost 79 per cent on the average. On the other hand a comparison of individual test results shows that the highest durability limit for forged samples is lower than the lowest value for extruded samples, the minimum extruded sample showing an increase of about 11.3 per cent above the highest value for forged samples.

Since the foregoing is based upon an actual production setup—in reality a pilot production line—it is safe to generalize that the extrusion process, when applied to the proper type of part, yields a relatively important cost economy; makes possible a major reduction in floor space and equipment; and, in addition, promises a worthwhile enhancement in physical properties, particularly in raising the fatigue limit of highly stressed parts.

Engine Cooling

(*Continued from page* 39)

rection. The smaller spring provides for prompt return of the poppet assembly to open position when the temperature drops. The valve is calibrated by adjusting the poppet on the threaded shank after which it is soldered in place. Variations up to about 10 F may thus be obtained; however, greater ranges require a change in the composition of the thermostatic wax.

The lubricating oil on road vehicles may also be cooled indirectly through a water-cooled oil cooler installed in the jacket water circuit between the radiator outlet and the engine. A cleanable oil cooler developed for this purpose is shown in Fig. 6. The oil flow path is through the tubes fitted with removable agitators which increase the heat transfer capacity by approximately 75 per cent.

The foregoing article was abstracted from the SAE paper, "Developments in Engine Cooling Systems," by Fred M. Young.

Hudson Layout

(*Continued from page* 29)

The body assembly then continues along the high level conveyor for additional assembly operations on the underside, this line terminating with the attachment of wheel and tire assemblies. The spare tire also is installed at this station, thus eliminating subsequent extra handling. Consequently the wheel chutes are scheduled to carry five wheel and tire assemblies for each car.

All major assembly operations take place on two parallel lines. Following wheel and tire installation, the two assembly lines, described above, move on to another section for completing the front end—which is still open up to this point. This section of the assembly line is raised above floor level to accommodate pits under the conveyor so as to facilitate certain operations on the under side of the car. On this line the car is met by a front end sheet metal drop, delivering assembled front end sections according to schedule. Later this assembly line drops down to floor level with the car riding on its own wheels, and at this stage the hoods are attached and adjusted. At the end of assembly the cars are driven off the line onto one of two final tune-up lines for adjustments and final inspection.

The high spots of this unique assembly procedure may be summarized briefly as follows:

1—Separate line for preparation of rear axle and spring assemblies.

2—Separate line for front chassis assembly—including power plant, steering gear, front suspension, battery, etc.

3—Painted but untrimmed body assembly fitted with rear axle sub-assembly on a high level assembly line.

4—Trimming and installation of hardware, wiring, etc., along assembly line.

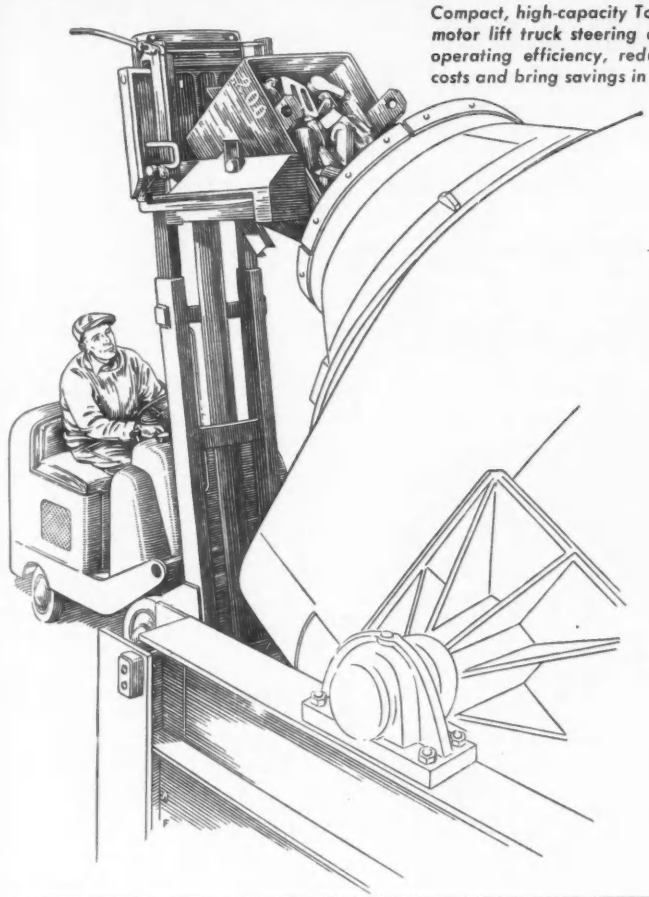
5—Attachment of front chassis assembly to front of trimmed body. fastenings and welding for permanent joints.

6—Completion of final assembly—wheel and tires, front and sheet metal, hood, etc.

7—Tune-up line ready for delivery to customer.

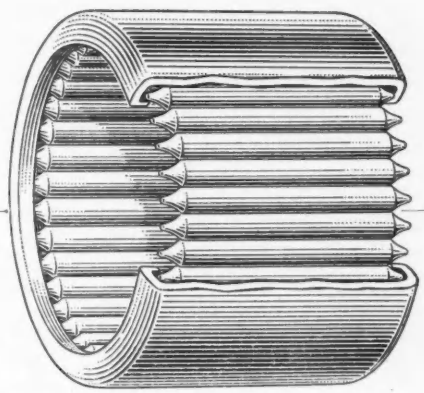
Borg-Warner Int'l Forms Ind. & Utility Section

The formation of an Industrial and Utility Section of Borg-Warner International Corp. has been announced by J. W. DeLind, Jr., president, Borg-Warner International. The new division, with headquarters in Detroit, will be headed by Claude Pitts, formerly general product manager, appliance section.



Compact, high-capacity Torrington Needle Bearings in Towmotor lift truck steering and load-lifting mechanisms raise operating efficiency, reduce lubrication and maintenance costs and bring savings in design, fabrication and assembly.

Lift Efficiency and Lower Costs with Torrington Needle Bearings



. . . in operation as well as in design and manufacture, these efficient anti-friction units reduce costs.

ONE WAY to give product efficiency a lift . . . and to put skids under operating and manufacturing costs . . . is to use Torrington Needle Bearings.

Check these features with your own product in mind:

1. *High capacity* means heavier payload, longer life, greater safety factor.
2. *Small size* allows streamlining, smaller component parts, compact construction.
3. *Light weight* means minimum dead weight, easy handling.
4. *Low friction coefficient* assures reduced power consumption, minimum wear.
5. *Efficient lubrication* means less maintenance attention, lower lubricating cost.
6. *Unit construction* provides simplicity of design, ease of assembly.

These cost-saving, efficiency-building advantages will work for you in the equipment you *build* . . . or *buy*. Our engineers will gladly give you the benefit of their specialized experience in adapting Torrington Needle Bearings to your product. Call or write the nearest Torrington office or direct to:

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H-72—Guide for Welded Construction

The Lincoln Electric Co.—Designer's Guide for Welded Construction, a six-page folder, contains a condensed summary of all the welding symbols to guide designers. Included also in the folder are specification tables on the different types of electrodes and additional suggestions for planning better welded designs.

H-73—Aluminum Sheet and Plate

Reynolds Metals Co.—The Aluminum Sheet and Plate Booklet covering 48 pages of technical information relative to various sheet and plate alloys, gages and sizes. It is designed to meet the needs of the experienced user of aluminum as well as to give the newcomer a much clearer insight into the advantages which aluminum has to offer. One of the final sections of the booklet gives an index of specifications for aluminum sheet and plate as listed by the various government bureaus and a number of the nation's leading professional societies.

H-74—Hydraulic Universal Grinder

Landis Tool Co.—A new catalog, J-48, describes and illustrates the Landis 14 in. and 18 in. Type C hydraulic universal grinder. There are 37 illustrations used in the 16 pages to show machine features, typical grinding operations and accessory equipment.

H-75—Power Trucks

The Elwell-Parker Electric Co.—Heavy duty die handling trucks at work in metal stamping and forging plants are described and illustrated in a ten-page booklet. Action photos reveal how effectively a truck operator manipulates dies weighing 50,000 lb or more. Facts are given relating to speed and economies with which trucks move dies in and out of storage departments, place them in operating position on press beds, or interchange them. Booklet gives principal specifications of truck models ranging from 2,000 to 54,000 lb carrying capacities.

H-76—Engineering Highlights

Westinghouse Electric Corp.—A 32-page booklet, Westinghouse Engineering Highlights, describes and illustrates drives and power conversion; illumination and electronics; power distribution, generation, and control, and other related subjects.

H-77—Taft-Hartley Law

Facts Illustrated, Inc.—What's in the Taft-Hartley Law, a 30-page illustrated booklet, presents the high spots of this law without passion or prejudice, and in an easily-understood style. While designed for purchase by employers for distribution to employees at their homes, sample copies are available on request.

H-78—Silicone Rubber

Dow Corning Corp.—New and more complete data on all commercially available types of Silastic, the Dow Corning silicone rubber, are given in Silastic Facts No. 5. Several new types of Silastic are included among the Silastic pastes and molding and extruding stocks for which typical physical properties including hardness, tensile strength and elongation are given.

(*Turn to page* 66, *please*)

TIME SAVER COUPON for your convenience in obtaining, WITHOUT OBLIGATION, more information on any one or more of the publications described above OR New Production and Plant Equipment OR New Products items described on other pages.

Automotive Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.

Please send me: **These FREE Publications** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Production and Plant Equipment** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Products** (Use letter and designating number of each item desired)
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Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

Bosch Diesel Engine Pumps

(*Continued from page* 46)

plunger closes the port on its upward stroke.

Situated directly above the plunger is a displacer piston (20), the function of which is to provide a means for limiting the maximum fuel delivery of the pump with wide open throttle to any desired value. The displacer piston (20) is spring-loaded downward onto its seat, from which it is lifted by the hydraulic pressure in the barrel below it after the plunger reaches the port-closing position of each upward stroke. Not until the displacer piston has been raised against its stop (17) can the hydraulic pressure in the barrel be increased sufficiently to open the delivery valve (15) and commence the effective portion of the plunger stroke. Adjustability of the position of the stop for the displacer piston provides the means for varying the maximum quantity of fuel which the pump can deliver with wide open throttle.

The single delivery valve (15) is situated laterally in the barrel (16) just above the topmost position of the plunger and on the side opposite the intake throttle. The valve, held against its seat by spring (14), is hydraulically lifted as a consequence of the plunger action. Fuel passing the delivery valve travels through ducts to the upper of the two annular cuts in the plunger, from which annulus rises a vertical groove (19) in the plunger. Continuous rotation of the plunger by the face gear at one-half pump camshaft speed permits the vertical groove in the plunger to serve as a distributor, communicating on successive working strokes with each of the outlet ducts from the barrel, which ducts are disposed radially in a horizontal plane. The plunger's rotating and reciprocating motions are so phased in relation to the outlet ducts that the vertical groove in the plunger overlaps one duct during the effective portion of each stroke and hydraulic communication is successively made with the discharge connections.

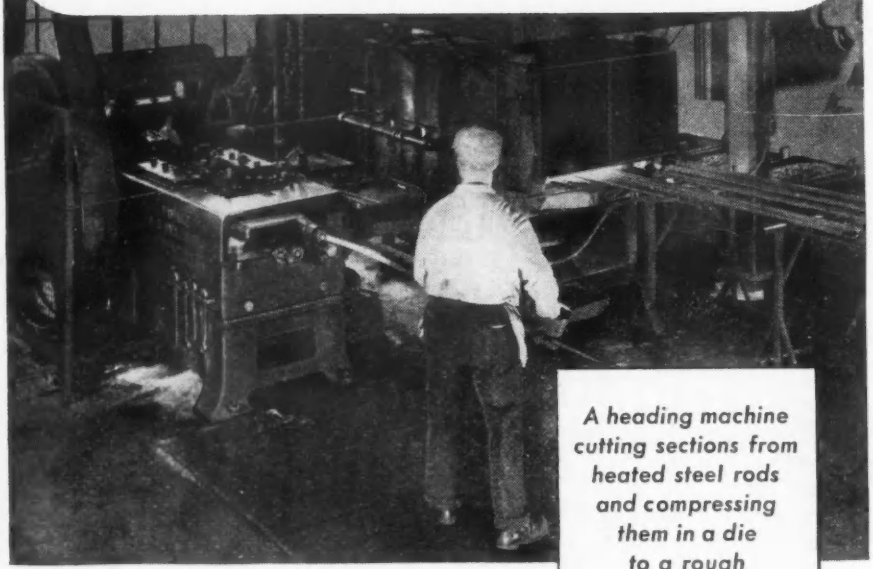
The fuel supply system feeding the throttle valve has as its major component a supply pump of the positive-displacement gear type and driven by the face gear. Located on the side of the PSA pump, the supply pump draws fuel from the storage tank and delivers it to the fuel inlet connection of the injection pump. A horizontal duct in the gear housing channels the fuel onward to a point under the barrel whence it flows upward through a passage in the barrel into the sump which houses the throttle valve. Surplus or bypassed fuel from this sump flows downward through another passage to the overflow valve where it acts against the valve spring. From this valve the bypassed fuel is returned to the storage tank from the outlet at the rear of the gear housing.

The variable-speed governor of the mechanical centrifugal type (30) is driven directly off the rear of the camshaft as shown in Fig. 2. Centrifugal throw-out of the governor weights (31) shifts axially the position of a sleeve on the governor shaft. This sleeve abuts against the governor lever assembly which in turn actuates the throttle valve to move it towards its shut-off position. The centrifugal force on the governor weights required to accomplish this, and therefore the rotative speed, are functions of the setting of the operating lever, because this lever is clamped to the operating shaft. The operating lever winds up the torsion spring when it is moved toward its full speed position, and the spring reacts on the governor lever assembly tending to move it, against the force applied by the sleeve on the governor shaft, in that direction which opens the throttle valve. The position of the operating lever, therefore, determines the spring force which must

(*Turn to page* 66, *please*)

This is How

STROM BALLS are Born



A heading machine cutting sections from heated steel rods and compressing them in a die to a rough spherical shape

The steel is carefully chosen and inspected, even before it gets to the heading machine. After being "born" here, balls are carefully "brought up," through a long series of grinding and lapping operations, to the unbelievably high standards of finish, sphericity and precision which have made Strom Metal Balls the standard of Industry. Strom Steel Ball Co., 1850 South 54th Avenue, Cicero 50, Illinois.

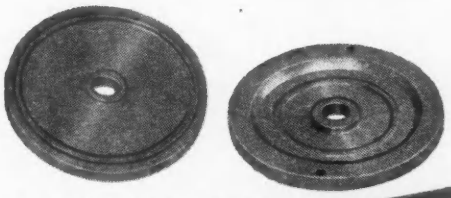
Strom BALLS Serve Industry

Largest Independent and Exclusive Metal Ball Manufacturer

Underwood tackles HIGH BREAK-EVEN POINT

The Underwood Corporation of Hartford, Conn. is completing a far-sighted program to eliminate production inefficiencies in the manufacture of their world famous typewriters and business machines. Obsolete equipment is being replaced by fully automatic machine tools.

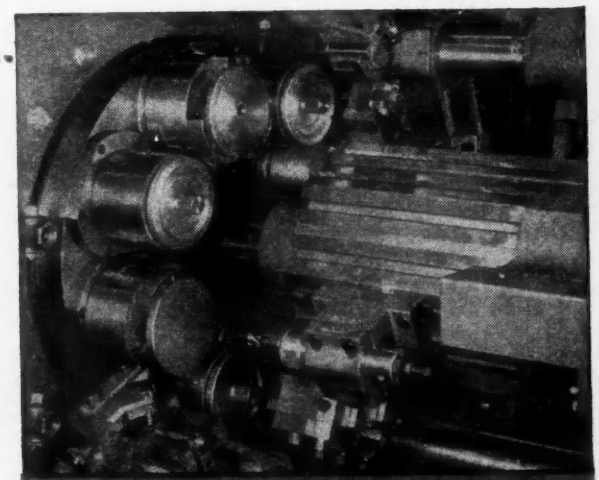
ON THIS PART



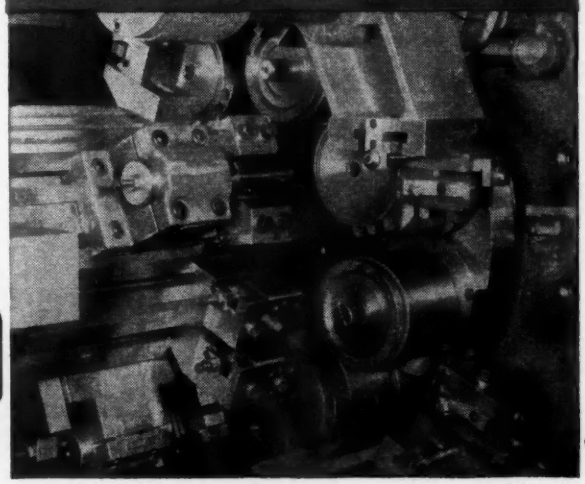
The production of the important type bar segment, illlustrated, is an example of this sensible approach to profits. It was formerly machined by six operators on four turret lathes, two engine lathes and one special grooving machine. These seven machines and six operators were replaced by one New Britain Model 88 Automatic Chucking Machine.

* RESULT

- Production increased from 90 to 120 pieces per hour
- Labor costs reduced 85%
- Quality of part greatly improved with tolerances held under 0.001"



The operations are finishing the O.D., facing both contoured sides, machining the I.D. of the hub, and trepanning wire grooves in one face. Simultaneous completion of both sides was made possible by arranging the machine for double index.



Are YOU Missing The Boat?

You can't afford to overlook the possibilities of lowering your break-even point in a similar manner. The parts you are now producing in your plant may well be produced cheaper and better on a New Britain Automatic.

The parts described in our new *Cost History* file were money-losers until New Britain engineering turned them into money-makers. Let us send you your free copy.

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Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

448HD1

Bosch Pump

(*Continued from page* 64)

be offset by governor force before governing takes place. The speed adjusting stop is clamped to the operating shaft and provides, in cooperation with the two stop screws, minimum and maximum adjustments at the extreme positions of operating lever travel.

An idle adjustment is provided by the leaf spring adjusting screw (24), (see Fig. 2). Leaf spring (26) can be adjusted by the screw so that its force will just balance the governor effect at the desired low-idle speed. Shut-off control is provided by a lever located on the opposite side of the pump from the operating lever.

The PSA pump is designed to receive pressure lubrication from the lubricating oil system of the engine to which it is applied. Oil under pressure (10-60 psi) can be supplied either through the face of the mounting flange, or through external tubing to the connection at the underside of the pump.

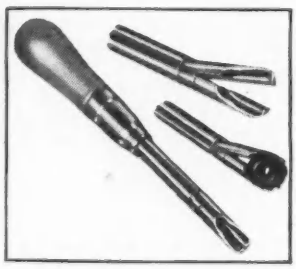
New Tool Inserts Rubber Grommets Quickly . . . Easily!

A new tool called a Grommet Inserter is shown above inserting a rubber grommet in a Sub-Chassis of a Zenith 7H820 Table Model Radio. The inset illustrates a close up view of the Grommet Inserter before and after the grommet has been inserted.

Anyone can insert grommets in an instant with the new Grommet Inserter. Saves time, labor, and assures perfect fit. No longer is it necessary to use the time-consuming, cumbersome method of insertion by hand. The new Grommet Inserter does it efficiently.

Simple as A-B-C. All you do is push the Grommet Inserter through the hole, open jaws, place grommet in jaws, and pull back—leaving grommet firmly in place, and perfectly fitted. Comes in four standard sizes: 1/4", 5/16", 3/8", 7/16". Can be furnished in any special sizes to order.

You can count on chewing gum, too, to help step up employee's on-the-job efficiency. Chewing gum helps relieve tension and thereby enables him to work quicker and easier while leaving hands free. That's why more and more plant owners are making Wrigley's Spearmint Gum available to everyone.



Grommet Inserter

Complete details may be obtained from
D. B. Rich Manufacturing Co., 6217 Melvina Avenue
Chicago 30, Illinois

AC-60

PUBLICATIONS AVAILABLE

(*Continued from page* 62)

H-79—Isothermal Heat Treatment

Ajax Electric Co.—Bulletin 120 describes the company's Isothermal Quench Furnaces. Several applications are illustrated; ordering information and specifications are included.

H-80—Special Handling Devices

Clark Equipment Co., Tructractor Div.—A new and colorful 40-page catalog presents the company's full line of machines and special handling equipment. Featured items are the Pul-Pac, the Hi-Lo Stack, etc.

H-81—Executive and the Taft-Hartley Act

The Budd Co.—The implications for executives in the 1947 Labor-Management Relations Act are set forth in a booklet written by John R. Bangs and James W. Townsend, Industrial Relations Director and Personnel Manager of the company. The responsibility resting on management in making the law work not only is indicated but clarified and emphasized.

H-82—Tool Grinders

Hammond Machinery Builders—A new 12-page catalog describes and illustrates the company's line of wet and dry carbide tool grinders, chip breaker tool grinders and diamond finishing tool grinders. A list of all new and improved carbide tool grinders, together with specifications for each machine, is included. The catalog title is Carbide Tool Grinder Catalog No. 220.

H-83—Die-Less Duplicating

O'Neil-Irwin Mfg. Co.—A new 40-page Di-Acro Catalog contains illustrations and specifications of all Di-Acro Precision machines which are available.

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Many of the nation's leading manufacturers, in widely diversified fields, use Berry Brothers finishes. All of them have profited directly from Berry Brothers 90 years experience . . in improved product quality, reduced costs and more efficient finishing operation.

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Booth
TRADE MARK

PRECISION CUT FELT PARTS

An Engineering Omission

(*Continued from page* 37)

a careful watch was kept. This overflow was forced out the air vent line and the airflow under the wing carried this fuel into the heater air inlet, resulting in a fire.

To most engineers this explanation will bring a grimace and a shudder of familiar understanding. Certainly the fuel system engineers could not have visualized any harm in the accidental spillage of fuel during in-flight transfer, nor could it be apparent from drawings that a pilot would leave a fuel booster pump on for 1½ hours. Nor is it logical that the heating and ventilating engineers could have foreseen any possibility of fuel entering the air intake. But the public knows well that 52 persons lost their lives and another 25 narrowly escaped.

To study the measures necessary for the safe return of the DC-6 to service, a DC-6 Modification Committee was formed to study detail changes in the airplane to prevent this or any other occurrence of fire in the air as well as means for fighting such a fire. The list of changes recommended by this Committee is far too lengthy to repeat here but an indication of their scope can be given. The changes are grouped into three categories: (A) Operation of the airplane with cabin superchargers but without the cabin heaters; (B) Operation of the airplane with cabin heaters but without cabin superchargers; and (C) Operation of the airplane with both cabin superchargers and cabin heaters.

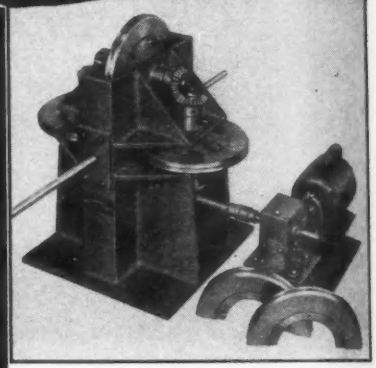
Class A changes include: inboard alternate fuel tank vent systems relocated; transparent inspection panels between the cabin and baggage compartments, heating compartment and hydraulic accessory compartment (to visually inspect for fire in flight); fire warning signals relocated adjacent to the selector needed for action; alcohol or heat de-icing system for the windshield, new cabin supercharger bearing (to prevent oil leakage through bearing into heater), fire warning devices added to heater and accessory compartments under floor; manual cabin depressurization control relocated away from potential fire zones; fire axes installed aboard the airplane; a smoke evacuation system developed; cabin heater completely disconnected, etc.

Class B changes include most of the above plus: stainless steel elbow and duct from cabin heater to mixing valve; automatic shutoff equipment added to heater when temperature exceeds 600° F.; separate intake scoop provided for cabin heater combustion air; combustion air outlet duct from

(*Turn to page* 70, *please*)

This special
Pannier
machine gives you
PRODUCTION-LINE MARKING
of SEAMLESS or LIGHT-WALL TUBING
. . . and stamps up to 4 sides on the same run!

ANOTHER Pannier FIRST



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Write for Bulletin No. LTM-1 . . . and for recommendations on *any* marking need.

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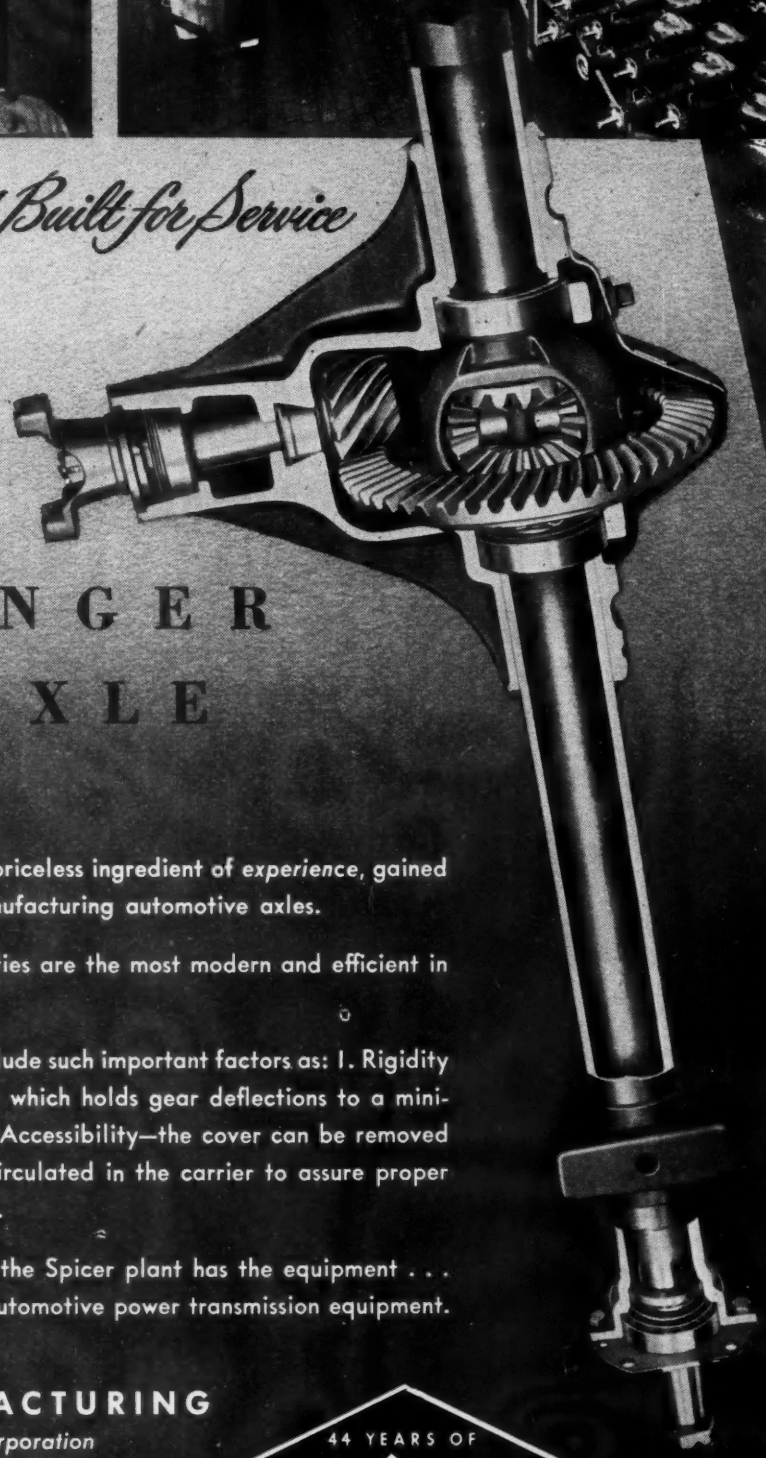

SPICER AXLE DESIGN has behind it the priceless ingredient of *experience*, gained by over 40 years of developing and manufacturing automotive axles.

SPICER AXLE MANUFACTURING facilities are the most modern and efficient in the world today.

SPICER CONSTRUCTION FEATURES include such important factors as: 1. Rigidity —an absolute essential for accuracy, and which holds gear deflections to a minimum, assuring quietness and long life. 2. Accessibility—the cover can be removed easily for inspection of parts. 3. Oil is circulated in the carrier to assure proper lubrication and cooling of moving parts.

Spicer engineers have the know-how . . . the Spicer plant has the equipment . . . to meet your individual requirements in automotive power transmission equipment.

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Division of Dana Corporation
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UNIVERSAL JOINTS
RAILWAY GENERATOR DRIVES

An Engineering Omission

(*Continued from page* 68)

heater provided with liquid-tight shroud, ventilated and drained, etc.

Class C changes include most of the above plus: supercharger oil cooler must be installed in separate box with an overboard drain; install insulation between all structure and stainless steel doublers at all heater exhaust outlets; improve cutouts in insulation around electrical terminals; install new lever type supercharger clutch disconnect controls, etc.

While this list appears lengthy, actually it is only about 10 per cent of the total changes on the airplane. But, believe it or not, the first fully modified DC-6 is now flying in California and the Douglas Aircraft Co. expects full Civil Aeronautics Administration approval of the airplane immediately. American Airlines, United Airlines and Pan American Airways plan the return of DC-6 transport service by April 15 and Douglas anticipates that in addition to these 93 domestic airplanes and 10 foreign airlines planes, the total quantity of 146 DC-6 transports completed to date will be flying this spring.

The cost of the error? Douglas Aircraft is assuming the entire cost of the gigantic modification program and company officials estimate that it will cost between three and four million dollars! In addition, the airlines estimate that their loss in passenger revenue will run between ten million and twelve million dollars. Assuredly, $13-$16,000,000 is a terrific penalty to pay for an almost undetectable oversight in the layout and design of a modern transport.

But a solution has been proposed and endorsed by the President's Air Policy Commission, airlines, manufacturers and interested parties: all new aircraft should be subjected to an extensive *non-passenger* flight "shake-down" period for a period of between 500 and 1000 hours. While such a long period appears expensive, it has been proposed that the 1000 hours be spent in cargo or freight operation so that revenue could result to partially offset the costs of such operation. No amount of blueprint reading, mockup inspection or laboratory testing can replace tests under actual flight conditions. The grounding of the Lockheed Constellation and the Douglas DC-6, our two most advanced transport aircraft, contain lessons for all engineers: if you can't predict it, don't guess—test it!

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1 Ton Capacity

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Boeing B-50

(*Continued from page* 45)

sumption by extending the operating range of the turbo, 43 per cent of the nozzlebox diaphragm area is automatically blocked off at low engine powers by means of a dam and a cruise valve. Air for cooling the turbo bearings and for the bucket wheel cooling cap is supplied by separate ducts from the plenum chamber.

A short duct on the forward left hand side of the plenum chamber supplies ram air to the supercharger compressor inlet. The compressor outlet delivers combustion air to the intercooler through a pressure duct on the bottom of the intercooler. A reflow duct connects the compressor outlet to the compressor inlet. Carburetor preheat and surge control are provided by means of the semi-automatic variable-position valves which governs the amount of air that is recirculated through this duct.

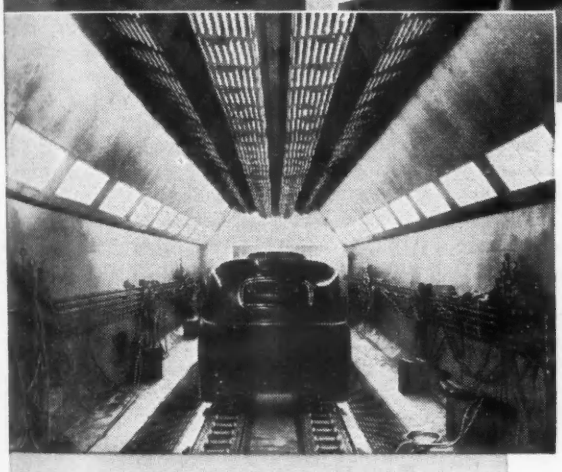
Intercooler

Combustion air from the compressor is passed through the intercooler where it is cooled by ram air flowing from the plenum chamber through the cooling passages in the intercooler and out through the exit duct. The B-50A

(*Turn to page* 72, *please*)

COMPLETE *Finishing* SYSTEMS

for ENAMEL • LACQUER • PAINT



The illustrations above show the interior of the Final Coat Hydro-Filter Spray Booth and a general view of the Final Coat Spray Booth and Drying Oven, which were installed in an open craneway. The Complete Mahon Installation at the Ford Truck and Bus Plant includes Metal Cleaning and Rust Proofing Equipment, Dry-off Ovens, Prime Coat Spray Booth and Drying Oven, Final Coat Spray Booths and Drying Oven for Small Parts, Final Coat Spray Booth and Drying Oven for Truck Cabs and Panel Bodies, Filtered Air Supply System for All Spray Booths, and a common Sludge Tank where the overspray from the several Spray Booths is deposited for reclamation or disposal.

Ford Truck Installation

Here is another typical example of Mahon planning and engineering. This Complete Finishing System was installed by Mahon in the Ford Truck and Bus Plant under conditions of restricted head room and other restrictive physical characteristics of the building. Part of the system was installed in an open craneway to obtain an efficient operating layout. What Mahon has done in hundreds of manufacturing plants throughout the world, he is prepared to do for you also. If you are confronted now with a finishing problem involving new equipment, do not hesitate to call on Mahon engineers . . . remember, that twenty-seven years of experience in this highly specialized field, together with constant research and development, have endowed Mahon engineers with a wealth of technical knowledge and practical know-how not available to you elsewhere. See Mahon Insert in Sweet's Mechanical Industries File for complete information, or arrange consultation.

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MAHON

Boeing B-50

(*Continued from page 70*)

intercooler effectiveness is almost twice that of the B-29 installation. Approximately 1000 lb of air per min are required by the intercooler for maximum cooling. Control of the carburetor air temperature within the limits of the heat from compression and effectiveness of the intercooler is provided by means of a variable-position, motor-actuated flap at the intercooler cooling air exit on the under side of the nacelle. A control switch on the engineer's switch panel controls the operation of the flap.

Turbo Bypass Door

When the supercharger is not operating (low powers and low altitude takeoffs), there could be considerable pressure lost in directing the ram air for the carburetor through the turbo compressor and the intercooler. To prevent this loss in the B-50A induction system, ram air from the plenum chamber is passed directly to the air filters through a flapper type bypass door whenever the turbo is not operating. This door is located on the top of the plenum chamber and opens into the intercooler header. It is so constructed that it automatically blocks off either the ram air from the plenum chamber opening or the supercharged air from the intercooler, whichever is at the lower pressure.

Carburetor Air Filters

Twin ducts, each incorporating a removable filter element, carry the ram or supercharged air from the intercooler header to the carburetor elbow duct. The filter walls are formed by two concentric tapered cylinders with a cap over the small end. The small end faces down into the airstream which flows into the outer surface and out of the inner surface of the filter. Concentric baffles attached to the filter housing duct guide the air through the filters so the carburetor metering will not be upset by uneven air flows. During military power operations, 415 lb of air per min pass through this section of the system to the engine. Removal of the filters for servicing is facilitated through incorporation of quick-disconnect latches on the removable elbow ducts above the filter compartments.

Oil Cooler

The oil cooler is installed at an angle in an opening on the right hand side of the plenum chamber. The amount of cooling air flowing through the unit, which is as high as 1500 lb per min, is governed by a flap at the exit opening on the right side of the nacelle. The flap is actuated by a jack screw driven by an electric motor which is controlled by a four-position switch on the engineer's switch panel. This switch allows either manual or automatic operation of the flap with automatic control being provided by a thermostat in the oil tank return line.

Accessory Air Duct

Ram air for cooling various accessories is taken from a common port on the upper side of the plenum chamber. Two blast tubes fastened to connections on the top of this duct supply cooling air to the generators. The tube to the left hand generator also has a connection that supplies air to the magneto pressurizing pump. Ventilation of the nacelle is provided by two tubes, one connected to a port on the front of the duct and one to a port on the aft side. This ventilating air is exhausted through a louver on each side of the upper part of the nacelle. Another flexible blast tube is connected to a port on the forward side of the duct and provides air for cooling the turbo shroud. This shroud is double-walled. The cooling air enters between the walls of the shroud at a connection on the upper forward end of the shroud and exhaust into the atmosphere through a louver at the aft end of the turbo wall.

(*Turn to page 76, please*)

LARGE CASTINGS — SMALL METAL PARTS — LONG THIN PIPES ARE THOROUGHLY AND QUICKLY CLEANED IN A

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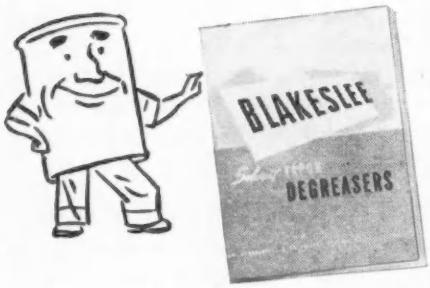
SOLVENT *Vapor* DEGREASER



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- ★ Excluding dirt, grit, dust
- ★ Retaining lubricants
- ★ Thermostatic insulation
- ★ Isolating vibration
- ★ Cushioning shock
- ★ Electrical insulation
- ★ Weight reduction
- ★ Temperature control
- ★ Padding, packing, seals
- ★ Air and liquid filters
- ★ Gaskets, channels, etc.
- ★ Grinding, polishing, etc.
- ★ Instrument mounts

Until you check the versatile qualities of felt against the specifications of your component parts, you may never dream that one material can serve so many uses—so *well.* Western Felt is readily processed to a wide range of densities—from wool soft to rock hard. Resilient, flexible, compressible—it offers high resistance to water, oil, heat and age. In many ways, Western Felt can be "engineered" to contribute materially to improved performance and dependability of your product.

If you have a possible use for felt, tell us the characteristics you require and our engineers will gladly help you to work out possible applications. No obligation. Write today!

Acadia Synthetic Division, Processors of Synthetic Rubber and Plastics; Sheets, Extrusions and Molded Parts

WESTERN FELT WORKS

4035-4117 Ogden Avenue, Chicago 23, Illinois

Branches in All Principal Cities

LARGEST INDEPENDENT MANUFACTURERS AND CUTTERS OF WOOL, HAIR AND JUTE FELTS

FINE ENOUGH FOR THE

LARGEST *Railroad* SYSTEMS

Photo courtesy L. & N. Railway

HUNDREDS of Layne Well Water Systems are now serving the Nation's largest railroads. And only in these systems have maintenance engineers found the rugged quality, long life and high efficiency that creates such unmatched reliability. Layne is proud of this splendid tribute to their years of sincere craftsmanship.

But railroads are not alone in this acknowledgement of water system superiority. The same preference applies to thousands of installations for cities, factories, dairies, chemical plants, petroleum refineries and irrigation projects.

The buying of a Layne Well Water System automatically obtains the very best of everything;—Layne skill in modern well drilling;—the correct type of screen and its proper installation;—the proper pump for sustained economical service;—and the final tests to prove that the system is thoroughly efficient in its operation.

For literature on Layne Well Water Systems address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

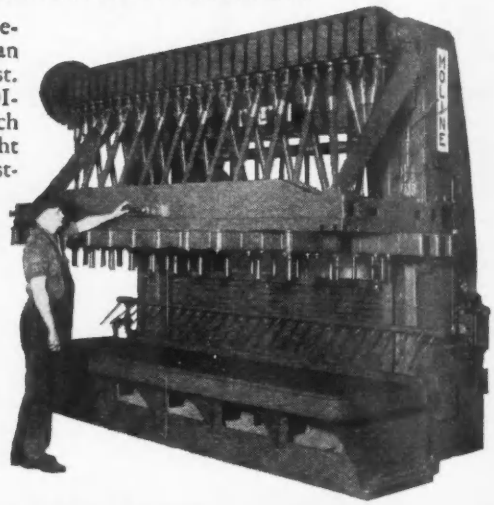
LAYNE WELL WATER Systems

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La., ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ Layne-Texas Co., Houston, Texas ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Western Co. of Minn., Minneapolis, Minn. ★ International Water Supply Ltd., London, Ont., Can. ★ Layne-Hispano Americana, S. A., Mexico, D. F.

★ At greater Man-Hour SAVINGS
★ At higher rated EFFICIENCY
★ At finer, effortless PRECISION

A Moline Multiple Spindle Specially Designed Machine Tool can do your job better at less cost. Ruggedly built to fit your INDIVIDUAL requirements in such operations as Boring — Straight Line Drilling — Universal Adjustable Spindle Drilling — Honing — Tapping — Reaming — Counterboring — Special Milling — these machines are based on years of experience accumulated since 1901.

For your SPECIAL problem, go "Hole-Hog" and write us for any information you may need.



No. HU68
DRILLER

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY
100 20th Street Moline, Illinois

(*Continued from page* 72)

Supercharged air for pressurizing the cabin is bled from the intercooler header in each of the inboard nacelles. As the power packages are interchangeable, the opening is present, but is capped on the intercooler headers in the outboard nacelles. A spring-loaded fire valve in the connecting duct closes automatically whenever the temperature in the nacelle melts a fusible link; fires are thus prevented from entering the cabin air system. A venturi in the cabin air duct from each nacelle limits the amount of air that is bled from the engine induction system in event of excessive leakage in the cabin air system. This maximum rate of air flow through the venturi never exceeds 20 lb per min. Indication of the rate of flow is provided by an instrument on the engineer's panel connected to ports on the venturi bell.

Transfer Machine

(*Continued from page* 36)

Although the machine is composed of four major units, it has a total of six individual stations and five idle indexing stations, four of which are designed to roll the work into proper angular position at each station. A general picture of the layout may be summarized as follows:

Station 1 has two fixtures; two vertical heads on the RH side; two angular heads on the LH side.

Idle Station—no indexing

Station 2 has two fixtures; two horizontal heads on the RH side, the first for drilling the large hole, the other for reaming; and two angular heads on the LH side.

Idle station—first change of index position

Station 3 has six fixtures (holds six crankshafts) with the following heads all on the RH side—four angular, two vertical, and two horizontal for completing the drilling of the reservoir holes.

Idle Station—second change of index position.

Station 4 has two fixtures; two vertical heads on the RH side; two angular heads on the LH side.

Idle Station—third change of index position.

Station 5 has two fixtures; two vertical and one horizontal head on RH side; and one horizontal, two-spindle head on LH side.

Idle Station—fourth change in index position

Station 6 holds a row of seven fixtures (seven crankshafts at a time with the following grouping of drilling heads: RH side—one horizontal single spindle head; LH side—one horizontal two-spindle head, one horizontal four-spindle head, four-spindle, angular head, two-spindle, vertical head.

Fully automatic in function, this outstanding machine requires only one operator who loads ahead of the first station and is responsible for operating the single master control panel. At the end of the unit work is automatically shifted into the idle unloading station and is responsible for operating —one piece at a time—permitting unloading by an operator who, doubtless, can tend a number of these machines.

GOOD SOLDER, AND ALL THIS TOO!

In Federated solder you get the exact metal you specify, PLUS all these intangible ingredients. These background factors mean service and security... they mean that you get *consistently* better solder to help you do a *consistently* better job.

For any size, form, or composition of solder—bar, pig, body, drop, foil and ingot; acid core, rosin core and solid wire; triangle, strip, wiping and segment — see Federated first.

Federated
METALS DIVISION

AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.

Federated first in the non ferrous field FMD

F-CCI2

Personals

Recent Personnel Changes and Appointments at the Plants of the Automotive and Aviation Manufacturers and Their Suppliers.

Kaiser-Frazer Corp. — **Fred R. Cooper** appointed Vice President in Charge of Sales, succeeding **W. A. MacDonald** who continues as a director of the corporation and a member of the executive staff. **Walter P. deMartini** will serve as Director of Sales, and **W. G. Morrison** has been named Assistant Director of Sales.

Wilson Foundry and Machine Co.—**Arthur J. Wieland** has been elected Vice-Chairman of the Board. Mr. Wieland recently was named Executive Vice-President of Willys-Overland Motors, of which the foundry is a wholly-owned subsidiary.

Ford Motor Co.—**A. R. Christenson** appointed Manager of the Truck and Fleet Dept. of the Des Moines district. Other changes include **H. G. Heller** as Asst. Manager of the Chicago District and **L. R. Peart,** Manager of Milwaukee District, Truck and Fleet Sales Dept. **C. V. Toussant** formerly manager of the Twin Cities District Truck and Fleet Dept. was promoted to Manager of the Midwest regions Truck and Fleet Dept., succeeding **H. G. Heller.**

Fisher Body Div., General Motors Corp.—**Donald W. Fleser** was named resident manager of the Atlanta plant, and **George Cameron** has been appointed assistant resident manager of the Fisher Plant No. 1 at Flint.

General Motors Corp. — **Frederick C. Horner** has retired as Director of the Field Operations Section of the Distribution Staff and he will be succeeded by **Light B. Yost,** formerly assistant to Mr. Horner.

Nash Motors Div., Nash-Kelvinator Corp.—**Howard G. Coates** appointed factory superintendent of the El Segundo, Calif., assembly plant, and **P. G. Little** made acting general works manager of the Kenosha, Wis., plant.

Plymouth Div., Chrysler Corp.—**Bryon E. Flechtner** appointed Director of Regions.

Motorola Inc. — **George R. MacDonald** named Vice President in Charge of Finance.

Tyson Bearing Corp. — **George C. McMullen** is Vice President in Charge of Sales; **W. H. Oexle** named General Sales Manager; and **Herschel J. Deal,** Vice President, is in charge of the Midwest territory.

Houdry Process Corp.—Brig. Gen. **David N. Hauseman,** U. S. Army retired, has been elected president to succeed **Eugene J. Houdry,** founder of the company, who retired.

Westinghouse Electric Corp. — Dr. **John A. Hutcheson** has been appointed Director of the Westinghouse Research Laboratories suceeding Dr. **L. Warrington Chubb** who is retiring. **Charles H. Weaver** has been named industrial manager and **Quincy M. Crater** becomes transportation manager for the central district office.

American Brake Shoe Co.—**Fred P. Biggs** appointed first vice president of the Brake Shoe and Casting Div., and **Frank P. Newbert** named assistant general purchasing agent for the company. **Roger W. Batchelder** appointed assistant to the president of the National Bearing Div. and **Wm. H. Old** named general purchasing agent for the American Brake Shoe.

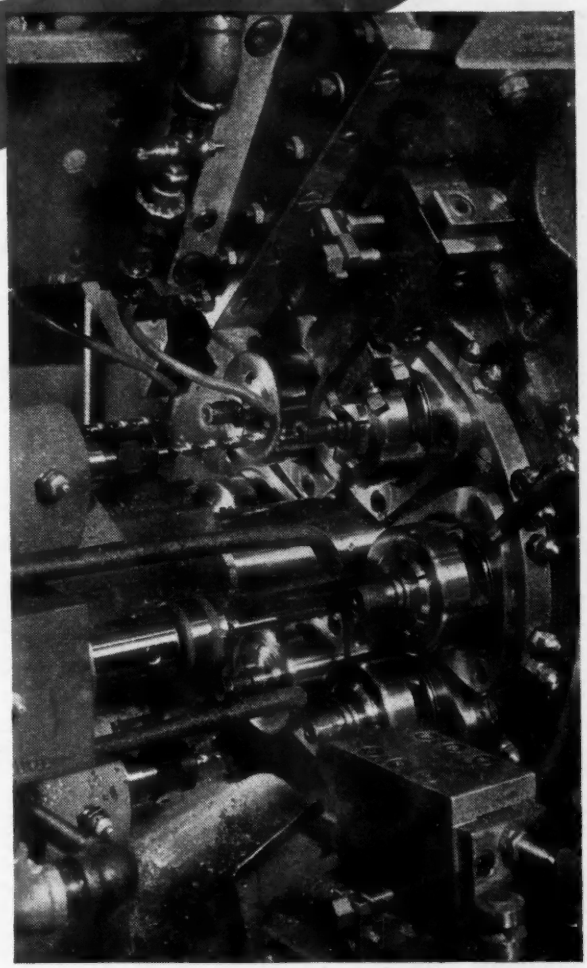
R. M. Hollingshead Corp.—**W. H. Lukens** announced as Vice President in charge of overseas sales.

Fram Corp.—**Wm. S. James** elected Vice President in Charge of Engineering.

American Cyanamid Co.—**James L. Rodgers, Jr.,** named general manager of the newly formed Plastics and Resins Div.

For DEPENDABLE SPRINGS
small stampings — wire forms
ILLINOIS COIL SPRING COMPANY
ALL TYPES
ALL SIZES
ALL MATERIALS
For PROMPT SERVICE
ILLINOIS COIL SPRING COMPANY
LARGE ORDERS OR SMALL
For REASONABLE PRICES
ILLINOIS COIL SPRING COMPANY
ON THE QUALITY YOU REQUIRE
• This is an ideal source of supply—large enough, experienced enough and well equipped to handle promptly any requirement for mechanical springs—small enough to want to do a good job for you. Your inquiries invited.
Write, Wire or Phone..NOW!
ILLINOIS COIL SPRING CO.
2100 N. Major Avenue
Chicago 39, Illinois

PROFITABLE PRECISION PRODUCTION WITH ACME-GRIDLEY AUTOMATICS



JOB FACTS

Bushing Valve Guide—Cast Iron

Concentricity of hole (2¼" long) and O. D. held within .002". Machine time, 4.1 seconds, or 878 pieces per hour—on Acme-Gridley 1" RA-6 Spindle Bar Automatic.

How the Job is Handled

Cast-iron parts come to the machine already rough center-less-ground. They are magazine fed through the rear of the spindle by mechanical means, and chucked on the large diameter against a stop. All six end working tool positions are utilized for tools. Air is injected through the 4th and 5th position collets, which, together with a heavy flow of light cutting oil, eliminate chip dust—insuring concentric chucking, essential to the .002" limits.

Why you'll get MORE GOOD PIECES IN THE PAN with Acme-Gridley Automatics

1. The design is stable—proved in use on more than 40,000 Acme-Gridley Multiple Spindle Automatics.

2. Rigidity and precision construction are combined in a finished machine that stands up—for exceptionally fine-tolerance work at high speeds.

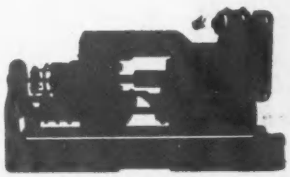
3. The design is adaptable—wide tooling zone with provisions for independent auxiliary drives places no limits on the ingenuity of tooling employed.

4. Quick change (positive) camming for both short and long run jobs insures sustained accuracy at high production rates—more good pieces in the pan.

May we show you how Acme-Gridley Automatics can increase profits and precision on your production?

THE NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO



ACME-GRIDLEY BAR and CHUCKING AUTOMATICS built in 1, 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

BOOKS ...

LESSONS IN ARC WELDING, third edition, published by *The Lincoln Electric Company, Cleveland, Ohio,* 158 pages, 5½ x 8½ inches, 228 illustrations, including photos and drawings; cover, semi-flexible simulated leather, gold embossed. The third edition of "Lessons in Arc Welding" has been so completely revised that it amounts to almost an entirely new book. It is designed to assist both new and experienced welders as well as all persons interested or concerned with the subject, with complete and thorough instructions in all phases of arc welding.

The book includes 58 lessons and has 228 photographs, illustrations and drawings to supplement the text. A feature is the "Questions and Answers" contained in the last 30 pages. The book sets forth in simple language the practical instruction based on the experiences of Arthur Madson, head instructor in the Lincoln Arc Welding School.

Published with the objective of aiding those interested in welding to use the process successfully and economically. "Lessons in Arc Welding", third edition, explains the fundamentals of this method of joining metals by the fusion principle and incorporates a wealth of new information such as complete treatment covering welding with alternating current, including both machines and electrodes in addition to the lessons on direct current welding; new procedures covering large electrodes with recommendations as to their use; newest electrodes and their use; a number of lessons on pipe welding; and data on the qualification of welding operators. A feature of interest to all is the complete discussion of distortion with recommendations regarding its prevention and control. An added feature is Lesson 47 containing a complete description of the principles of hard-facing.

The book is mailed postage prepaid anywhere in the United States for 50 cents per copy, 75 cents elsewhere.

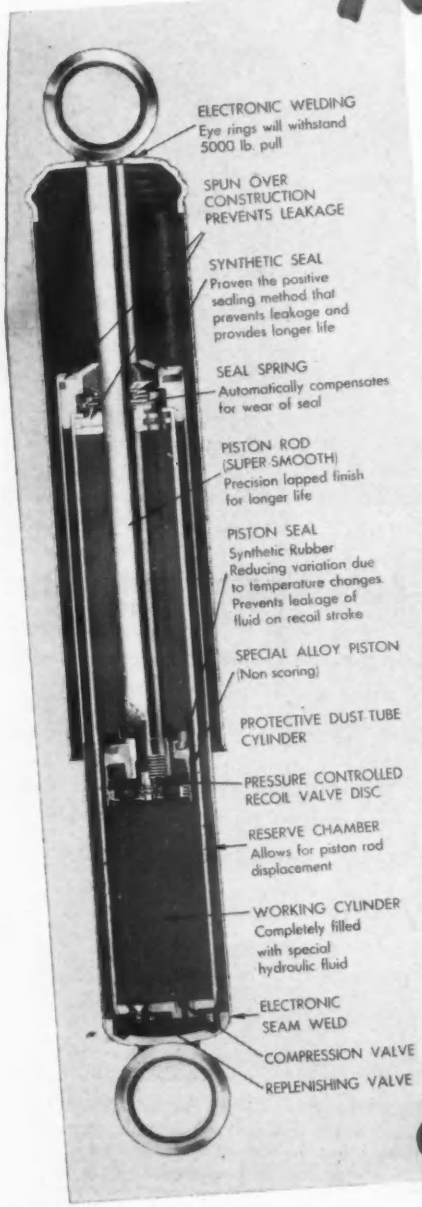
A.S.T.M. STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS. The greatly expanded 1947 volume of A.S.T.M. Standards on Petroleum Products and Lubricants (With Related Information) covers some 710 pages. In it are the more than 130 test methods, specifications, and definitions, which the A.S.T.M. has issued covering a wide range of petroleum products.

While the standards are arranged according to the sequence of their numeric designations, there is a detailed table of contents listing the standards according to the general fields covered, and also a subject index.

There are a number of tests and specifications for motor and aviation fuels and another large group pertains to Diesel and burner fuels, kerosene and illuminating oils. Through the work of Committee D-2, which is responsible for most of the standards given, the Society has issued many tests for lubricating oils and grease, petrolatums and paraffin waxes. Also covered are plant spray oils and petroleum sulfonates. There is a group of tests covering electrical insulating oils and an extensive series of specifications (17) and tests (18) on hydrocarbon solvents. Other petroleum products covered are asphaltic materials, with several specifications and numerous tests. The book gives tests pertaining to crude petroleum and requirements on thermometers. This compilation includes all A.S.T.M. requirements on petroleum except those for engine test methods on fuels.

Available in heavy paper cover or cloth, copies can be procured from *A.S.T.M. Headquarters,* 1916 *Race Street, Philadelphia* 3, *Pa.,* at $4.75 in paper cover and $5.40 in cloth binding.

EXCLUSIVE FEATURES of Gabriel AEROTYPE SHOCK ABSORBERS


ELECTRONIC WELDING
Eye rings will withstand 5000 lb. pull
SPUN OVER CONSTRUCTION PREVENTS LEAKAGE
SYNTHETIC SEAL
Proven the positive sealing method that prevents leakage and provides longer life
SEAL SPRING
Automatically compensates for wear of seal
PISTON ROD (SUPER SMOOTH)
Precision lapped finish for longer life
PISTON SEAL
Synthetic Rubber
Reducing variation due to temperature changes.
Prevents leakage of fluid on recoil stroke
SPECIAL ALLOY PISTON
(Non scoring)
PROTECTIVE DUST TUBE CYLINDER
PRESSURE CONTROLLED RECOIL VALVE DISC
RESERVE CHAMBER
Allows for piston rod displacement
WORKING CYLINDER
Completely filled with special hydraulic fluid
ELECTRONIC SEAM WELD
COMPRESSION VALVE
REPLENISHING VALVE

Contribute to More Uniform Ride Control Throughout All Temperature Ranges, Improved Passenger Comfort And Long Service Free Shock Absorber Life

Experience gained over nearly half a century of ride control engineering is available through a qualified Gabriel ride engineer. Write or phone or wire for free consultation.

THE Gabriel COMPANY
CLEVELAND 3, OHIO

Arthur W. Coppin

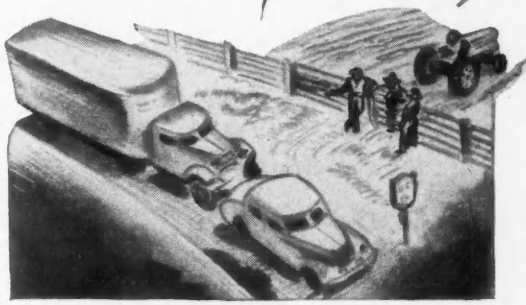
Arthur W. Coppin, 51 secretary, Foote Bros. Gear and Machine Corp., Chicago, died on March 2 in Chicago.

CALENDAR

Conventions and Meetings

Natl. Assoc. of Corrosion Engineers Mtg., St. Louis ..... Apr. 5-8
Midwest Power Conference, Chicago.. Apr. 7-9
Southern Mach. & Metals Exposition, Atlanta ..... Apr. 5-8
Metal Powder Assoc. Annual Mfg. & Exhibit, Chicago ..... Apr. 15-16
Westinghouse Mch. Tool Electrification Forum, Buffalo ..... Apr. 22-23
Chamber of Commerce of the U. S. Annual Mtg., Washington, D. C. Apr. 26-29
Amer. Management Assoc. Packaging Exposition & Conference, Cleveland Apr. 26-30
American Foundrymen's Assoc.—Foundry Show, Phila. ..... May 3-7
Soc. for Experimental Stress Analysis—Annual Mtg., Pittsburgh ..... May 27-29
32nd International 500-Mile Race, Indianapolis ..... May 31
Natl. Air Races, Cleveland ..... Sept. 4-6
Instrument Soc. of Amer. Natl. Instrument Conf. & Exhibition, Phila. Sept. 13-17
Commercial Motor Transport Show, London ..... Oct. 1-9
Society of Motor Mfrs. International Motor Exhibition, London Oct. 28-Nov. 6

Hats Off TO THE VETERANS!



Old? Sure, but what a big hand they're getting—those veteran, pre-war cars, trucks and tractors that are still on the ball . . . riding out the *"Shortage forties"* . . . piling up astonishing records of enduring usefulness and dependability.

And it's significant that the highest tributes come from men who "live behind the wheel"—from traveling men, truck drivers and tractor operators who hold deep, experience-bred respect for the LITTLE things which team up to make such a BIG difference in motor vehicle life and upkeep.

Take, for example, that vital clutch release job. That's where trustworthy Aetna T Type bearings are playing their obscure but important part in stretching vehicle life. Designed with unique, patented features which make for reserve stamina and long life, these superior bearings long ago proved themselves "Naturals" for tough times like these.

Indeed, tough times, tough jobs are duck soup for Aetnas—seem only to mark them more definitely as being clutch release bearings that are beyond all serious competition.

That's why leading car, truck and tractor manufacturers first standardized on Aetna Clutch Release Bearings—why they've never switched from them. Why not make them your choice too?

FIRST STANDARD EQUIPMENT CHOICE OF LEADING CAR, TRUCK AND TRACTOR ENGINEERS

Large capacity, beveled lubricant chamber insures constant circulation and long-life retention of lubricant.

T-shaped, sturdy, one-piece, oil-filled bronze ball separator maintains fixed alignment, provides the added smoothness and durability of steel to bronze contact.

AETNA BALL and ROLLER BEARING COMPANY

4600 SCHUBERT AVENUE

CHICAGO 39, ILLINOIS

IN DETROIT: SAM T. KELLER

2457 Woodward Av. • Ph. Cadillac 2040

The Best in Industrial Bearings, Too!

Aetna products include standard and special ball thrust bearings, angular contact ball bearings, special roller bearings, ball retainers, hardened and ground washers, sleeves and bushings. Write for the new Aetna Engineering Catalog —TODAY!

Aetna

BALL AND ROLLER BEARINGS

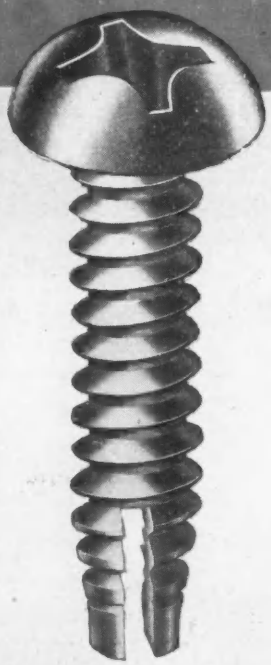
NEW "TAP" SCREW
is actually a cutting tool that removes material to TAP its own threads!

ELIMINATE
TAPPING COSTS

Here's how it's done. The slot, corresponding to flutes of a tap, provides two balanced cutting edges and a chip reservoir. *In photo, note chips cut and pushed ahead.*

HOLTITE "TAP" SCREWS

U.S. Patent No. 2,292,195 Other patents pending.



Do not confuse this remarkable new screw with the ordinary self-tapping screws that forcibly displace the material by a cold forging action.

Fundamentally a narrow fluted two-flute tap, this new "TAP" screw actually removes the material when *cutting* its own perfect mating threads to effect tighter, stronger fastenings that resist vibration.

Fine or curled metal chips, and tough, gummy non-metallic cuttings free themselves readily in the open slot reservoir to prevent binding. The two balanced cutting edges of slot cut threads much deeper than their own diameter.

Eliminate tapping operations by using HOLTITE "TAP" screws in metal, castings, alloy, rubber, plastics, etc. You'll get stronger fastenings at less cost!

CONTINENTAL
SCREW CO. New Bedford, Mass., U.S.A.

General News

(*Continued from page* 23)

Fuller Mfg. Co. Buys Reed Foundry

Another step in the expansion program of Fuller Manufacturing Co., Kalamazoo, Mich. has been taken with the purchase of the Reed Foundry and Machine Co., Kalamazoo. Providing an area of 40,000 sq ft, the newly-acquired foundry has an estimated daily capacity of 15 tons of gray iron castings.

National Screw Merges with Hodell Chain

The National Screw & Mfg. Co., Cleveland, has announced the acquisition of the Hodell Chain Co., also of Cleveland.

Macauley Retires From Packard

One of the pioneers of the automobile industry Alvan Macauley, recently retired as board chairman and director of the Packard Motor Car Co. Henry E. Bodman and Robert B. Parker, directors, also retired. Mr. Macauley joined Packard as general manager in 1910, became president in 1916, and board chairman in 1939.

Government to Allocate Synthetic Rubber

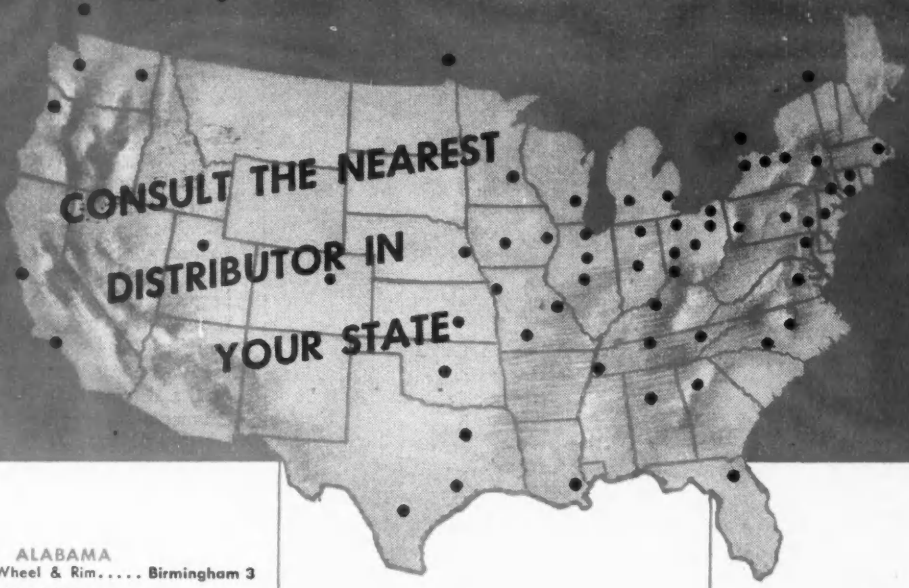
Wartime allocation controls were recently reimposed by the government on general purpose synthetic rubber. The rubber industry recommended that the controls be reimposed because supply was not sufficient to meet mounting demand. The Dept. of Commerce will allocate the synthetic rubber to various producers and control the amount to be used in various products. About 73,000 tons of general purpose synthetic had been earmarked for distribution until the end of March, largely for tires.

Resumption of control over the distribution of general purpose synthetic rubber by the Dept. of Commerce will not mean any drop in the production of tires. In fact, Commerce officials emphasize that this action will result in keeping tire output at peak levels. Quantities allocated to tire producers will be sufficient for the manufacture of the same number of units as were turned out in the base period. Meanwhile, legislation to assure continued operation of the synthetic rubber industry appears headed for Congressional approval. The measure before Congress will require the preservation of plants with an annual capacity of 675,000 tons of synthetic and also the actual output and use of at least 225,000 tons annually.

(*Turn to page* 84, *please*)

for Superior Replacement or Special Change-over Service on—

WHEELS and REPLACEMENT PARTS...



ALABAMA
Cruse-Crawford Wheel & Rim..... Birmingham 3

CALIFORNIA
Motor Rim & Wheel Service..... Los Angeles 15
Motor Rim & Wheel Service..... San Francisco 9

COLORADO
Quinn & McGill Motor Supply..... Denver 1

CONNECTICUT
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Connecticut Wheel & Rim..... New Haven 11

FLORIDA
Southeast Wheel & Rim Co..... Jacksonville 3

GEORGIA
Harris Automotive Service..... Atlanta 3

ILLINOIS
Stone Wheel Incorporated..... Chicago 16
Peoria Wheel & Rim Company..... Peoria 3
Illinois Wheel & Brake Sup..... Springfield

INDIANA
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IOWA
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Des Moines Wheel & Rim Co..... Des Moines 12

KANSAS
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KENTUCKY
Auto Wheel & Rim Service..... Louisville 3

LOUISANA
Southern Wheel & Rim Co..... New Orleans 13

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MASSACHUSETTS
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MICHIGAN
Rim & Wheel Service..... Detroit 2
Rim & Wheel Service..... Grand Rapids 2

MINNESOTA
Pioneer Rim & Wheel Company.... Minneapolis 4

MISSOURI
Borbein-Young & Company..... Kansas City 8
Borbein-Young & Company..... Springfield
Borbein-Young & Company..... St. Louis 8

NEBRASKA
Morgan Wheel & Equipment..... Omaha 2

NEW JERSEY
Wheels Incorporated..... Newark 4

NEW YORK
Wheels, Incorporated..... Albany 1
Frey, The Wheelman, Inc..... Buffalo 3
Wheels, Incorporated..... New York 23
Frey, The Wheelman, Inc..... Rochester 7
Colbourn Wheel & Rim Co..... Syracuse 4

NORTH CAROLINA
Carolina Rim & Wheel Co..... Charlotte 1
Carolina Rim & Wheel Co..... Raleigh

OHIO
Motor Rim Manufacturers..... Akron
Rim & Wheel Service..... Cincinnati 2
Motor Rim Manufacturers..... Cleveland 1
Hayes Wheel & Spring Service..... Columbus 15
Rim & Wheel Service..... Dayton 3
Wheel & Rim Sales Company..... Toledo 4

OKLAHOMA
Southwest Wheel Inc..... Oklahoma City 1

OREGON
Auto Wheel Service..... Portland 9

PENNSYLVANIA
Standard Wheel & Rim Co..... Harrisburg
Kay Wheel Sales Company..... Philadelphia 4
Thomas Wheel & Rim Company... Philadelphia 30
Wheel & Rim Sales Company..... Pittsburgh 13

TENNESSEE
Harris Automotive Service..... Knoxville 17
Beller Wheel, Brake & Supply..... Memphis 3
Beller Wheel, Brake & Supply..... Nashville

TEXAS
Southwest Wheel Inc..... Dallas 2
Southwest Wheel Inc..... Houston 2
Southwest Wheel Inc..... San Antonio 6

UTAH
Henderson Rim & Wheel Serv..... Salt Lake City 1

VIRGINIA
Dixie Wheel Company..... Richmond 20

WASHINGTON
Motor Wheel & Parts Co..... Seattle 22
Bearing & Rim Supply..... Spokane 8

WISCONSIN
Stone Manufacturing Company..... Milwaukee 3

CANADA
Alberta Wheel Distributors..... Edmonton, *Alberta*
General Automobile Equip..... Montreal, *Quebec*
Wheel & Rim Co. of Canada..... Toronto 5, *Ontario*
Wheels & Equipment Limited..... Vancouver, B. C.
Automobile Supply Company... Winnipeg, *Manitoba*

ASSURES PROVEN PRODUCTS AT . . .

KELSEY-HAYES WHEEL COMPANY

DETROIT 32, MICHIGAN

Wheels—Hub and Drum Assemblies—Brakes—"Vacdraulic" Brake Power Units—for Passenger Cars, Trucks, Buses—made by Kelsey-Hayes' 4 Michigan Plants and Windsor-Canada Plant • "Magdraulic" Electric Brakes—"Lathan" Vacuum Power Brake Equipment for Tractor-Trailers—made by Kelsey-Hayes' South San Francisco-Lathan Plant. Wheels—Hubs—Axles—Parts for Farm Implements—made by Kelsey-Hayes' French & Hecht Plant at Davenport, Iowa.

General News

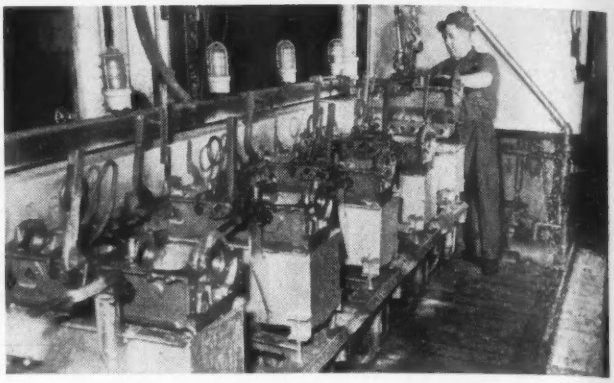
(*Continued from page 82*)

Hamilton Standard Making Giant Propeller

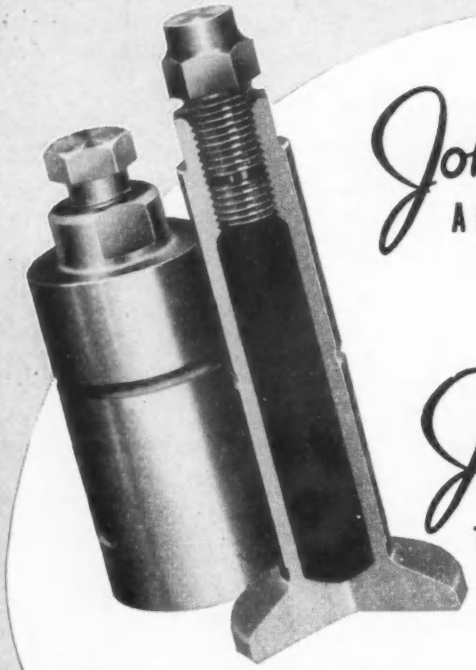
Hamilton Standard Propellers Div., United Aircraft Corp., is now manufacturing the largest propeller ever placed in production at the East Hartford plant. The new propeller, 16.5 ft in diameter, is also the first reversing Hydromatic to use four hollow-steel blades. First commercial airplanes to receive the big propeller will be 36 of the 55 Boeing Stratocruisers now on order.

COAT FOR CYLINDERS

A protective oil-absorbing coating is now being applied to the cylinder walls of all engines being made by Chrysler's Dodge Div. A Dodge engine block is shown being lowered into one of the tanks in which the coating is applied. An individual electric control on each tank regulates the timing of the process.



The Best Combination
for FINE ENGINE PERFORMANCE



Johnson ADJUSTABLE TAPPETS
and the
Johnson SELF-LOCKING TAPPET SCREW

The Johnson Self-Locking Tappet Screw is made from the finest Steel, accurately heat treated to give it toughness and long life. The flexible spring action of the diaphragm holds the threads fully and rigidly seated at all times. The entire load is carried by the solid portion of the screw.

The Johnson Self-Locking Tappet Screw has no leading edges and is not self-tapping. Effectiveness is maintained through any number of adjustments.

Write today for the latest Johnson TAPPET BULLETIN.

Johnson PRODUCTS INC.
MUSKEGON, MICHIGAN
"Tappets Are Our Business"

Steel Union Says No Strike This Spring

Automobile manufacturers breathed a little easier recently when Philip Murray, president of the United Steel Workers, said that his union intends to honor strictly its no-strike contract with the steel industry during wage negotiations coming up in April. The union is operating under a two-year contract that can be reopened once for wage discussions, but prohibits a strike during the life of the contract. Consequently it appears that steel at least will not be tied up by a strike this spring.

Fairey Co. To Produce Primary Trainer

The Fairey Co. has entered the light aircraft market with its Primary Trainer. Refinements in design and equipment, together with a modern engine, make the airplane a new type, though its basic design was initiated in 1938 by E. O. Tips, a Belgian aeronautical engineer closely associated with Fairey Aviation for many years.

Display 1948 Jaguars in New York

The 1948 Jaguar automobiles were recently displayed in New York City. Manufactured by Jaguar Cars, Ltd., Coventry, England, the cars are powered by a six-cyl, 125-hp engine, and the delivered price in New York City of the convertible model is $4745 and of the four-door sedan, $4633.

Mooney Scores Russia As Peace Threat

America's participation in European recovery should be based on practical power politics and "on the acceptance of the practical fact that the only real threat to our own American peace, and the peace of the world today is aggressive, belligerent Russia," James D. Mooney, president and board chairman of Willys-Overland Motors said recently. Addressing the American Society of Tool Engineers at its annual banquet, Mr. Mooney endorsed full, effective

(*Turn to page 86 please*)

MODEL 30H MAN-AU-TROL HORIZONTAL LATHE PRODUCES 3 IDENTICAL PIECES IN LESS TIME THAN NORMALLY REQUIRED FOR ONE

Meeting demand for lower production costs on between-center shaft turning work which calls for turning, grooving, facing and angle-turning, this new BULLARD Man-Au-Trol machine offers advantages never before found in horizontal lathes.

3 Identically-Tooled Spindles Cut Unit Costs

Turning out three finished pieces per cycle . . . with simplified tooling for rough and finish cuts, with Man-Au-Trol keeping tools cutting almost continuously . . . the BULLARD Model 30H Lathe not only outproduces three ordinary horizontal lathes but also reduces tooling costs.

Makes the Operator's Job Easier

The BULLARD Man-Au-Trol Horizontal Lathe has headstock and all operating controls conveniently located at the operator's right. Each of the three hydraulically-operated chucks is controlled by a foot treadle . . . leaving the operator's both hands free. Work and tools are always visible and easily accessible to the operator without reaching across tools or tool slide.

An Automatic All-Purpose Machine

Man-Au-Trol, *the automatic control that is as versatile as manual control*, makes this highly productive lathe an all-purpose machine. Quickly and easily changed over from one job to an endless variety of other jobs and convertible from automatic to manual operation at the turn of a single lever, it is practical for long or short runs.

Write for Literature

The unique combination of productivity, convenience, versatility and accuracy makes the new BULLARD Model 30H Man-Au-Trol Horizontal Lathe worth investigating. Complete specifications will be sent on request.

THE BULLARD COMPANY,
Bridgeport 2, Conn.

BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE
HORIZONTAL LATHE
Model 30H

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

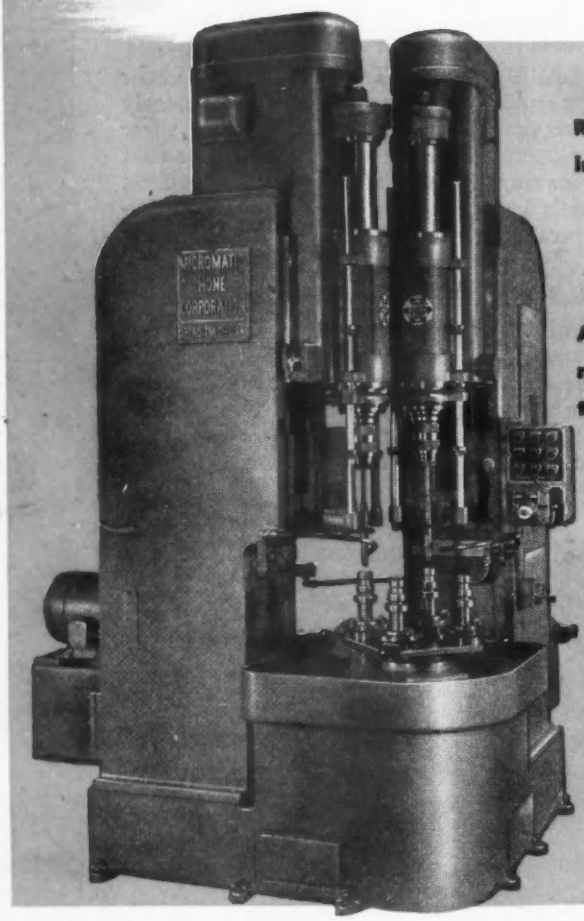
MEMO

Lets look into this

machine

for heavy-duty multiple or progressive

MICROHONING



Removes more stock in less time.

Automatically maintains closer tolerances

REDUCES COSTS!

MODEL NO. 730

3510

Micromatic now offers a new multiple spindle, unit constructed, Quill type machine with added power and control for removing more and more stock in less time from harder materials. Completely automatic, electronic control of uniform size within .0001 to .0003 inch in production.

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55 George St., Brantford, Ont., Canada
Micromold Manufacturing Div., Boston Post Road, Guilford, Conn.

General News

(*Continued from page* 84)

participation in European and world recovery, and offered basic principles which should be used as conditions for American aid.

Warner Automotive Adds to Auburn Plant

Warner Automotive Parts Div., of Borg-Warner Corp. has started construction of a new addition to its Auburn, Ind., plant. The new unit will be a one-story building 80 by 200 ft. and will house the grinding and axle shaft department.

Largest Antique Car Show in NYC, Mar. 8-14

Over 100 early model automobiles and horseless carriages, were exhibited in New York City on Mar. 8-14. New York City's biggest antique automobile exposition was staged under the auspices of the Veteran Motor Car Club of America.

Weiland Proposes 8-Point Export Program

An eight-point program designed to provide "new sights, new yardsticks and new ideas to substitute for the old formulas" of world trade was proposed by Arthur J. Weiland, executive vice-president of Willys-Overland Motors in an address given before the Institute on Business Trends of the University of Toledo, recently. Mr. Weiland, former vice-president in charge of sales for General Motors Export Div. advocated the abolition of cartels and the split up of the world into "areas of influence." The world, he said, "should be able to buy where it can secure the best bargains."

Obituary

Edmund H. Reed

Edmund H. Reed, 61, director of purchases, Electric Auto-Lite Co., died on March 11 in Toledo, O.

Robert S. Gray

Robert S. Gray, supervisor automotive manufacturer sales, Electric Storage Battery Co., Philadelphia, died on March 9.

Classified Advertisement

SMALL ENGINE TEST EQUIPMENT: G. E. engine test dynamometer rated 10 HP, absorption 2500/6000 RPM.
Including Toledo dial scale, bracket mounted tachometer and revolution counter, starters and starting heaters. Complete motor generator set. Equipment in original crates. Viking Tool & Machine Corp., 2 Main St., Belleville 9, N. J.